EXHIBIT A

QSI CONSULTING, INC.

VIABILITY OF BROADBAND COMPETITION IN BUSINESS MARKETS

An Analysis of Broadband Network Unbundling Policies and CLEC Broadband Competition

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This paper analyzes the costs incurred by CLECs when (a) leasing ILEC facilities (UNEs, collocation, special access circuits, etc.) and/or (b) self-provisioning. This analysis demonstrates that the FCC's Broadband Forbearance orders have impeded the ability of CLECs to compete in the market for broadband services for small and medium size business customers, a segment that currently suffers in terms of broadband availability and affordability. Our results demonstrate that open access policies would better promote the availability and affordability of broadband services for such customers. This paper completes an earlier Working Paper, released on November 19th, 2009.

Table of Contents

I. INTRODUCTION

a. Purpose

The overarching purpose of this paper is to contribute to the Federal Communications Commission's ("FCC's") on-going formulation of an appropriate National Broadband Plan[1] and to explore the linkage between adoption of open access policies on the one hand and greater availability, affordability, and capacity of broadband services on the other, as open access expands competitive supply and innovation.[2]

Specifically, this paper explores the benefits of open access policies against the backdrop of a competing theory, which maintains that forcing incumbents to lease their network to competitors will undermine that industry's incentives to invest in higher capacity networks to begin with, and without that investment, the desired outcomes will not materialize. It is the latter theory that has prevailed in recent years as the FCC reversed its initial course of open access policies, with respect to broadband services during the early years of implementing the 1996 *Telecommunications Act,* and subsequently began to progressively close off competitors' access to incumbent broadband networks.[3]

In this paper, we provide several detailed, business case-oriented analyses that demonstrate the significant economic constraints that new entrants face when attempting to offer Ethernet services to small and medium size business customers under the FCC's broadband forbearance policies. We examine the economic viability of provisioning Ethernet services by new entrants to potential customers under the following *two* alternative arrangements:

- *Lease local loop and transport facilities* from incumbent local exchange companies ("ILECs");
- *Self-provision* local loop and transport facilities.

Our economic viability analysis demonstrates that the FCC's broadband policies significantly limit new entrants' ability to compete for the small and medium sized business markets, the very segment that has been identified as lacking in competitive alternatives.

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1 FCC GN Docket No. 09-51, *A National Broadband Plan for Our Future.*

2 This issue is also being considered in such proceedings as FCC-09-65 *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, Notice of Inquiry, July 2009; and, *Comments Sought on Broadband Study Conducted by the Berkman Center for Internet and Society*, NBP Public Notice # 13, Pleading Cycle Established, GN Docket Nos. 09-47, 09-51, 09-137. Also see the FCC Commissioned Berkman Report. *http://www.fcc.gov/stage/pdf/Berkman_Center_Broadband_Study_13Oct09.pdf.*

3 See Section II.c of this paper.

The next section of our paper provides an overview of our two-part analysis – Part I: *Economic Viability of Leasing ILEC Facilities*, and Part II: *Economic Viability of CLEC Self-Provisioning Facilities* – and our preliminary findings.

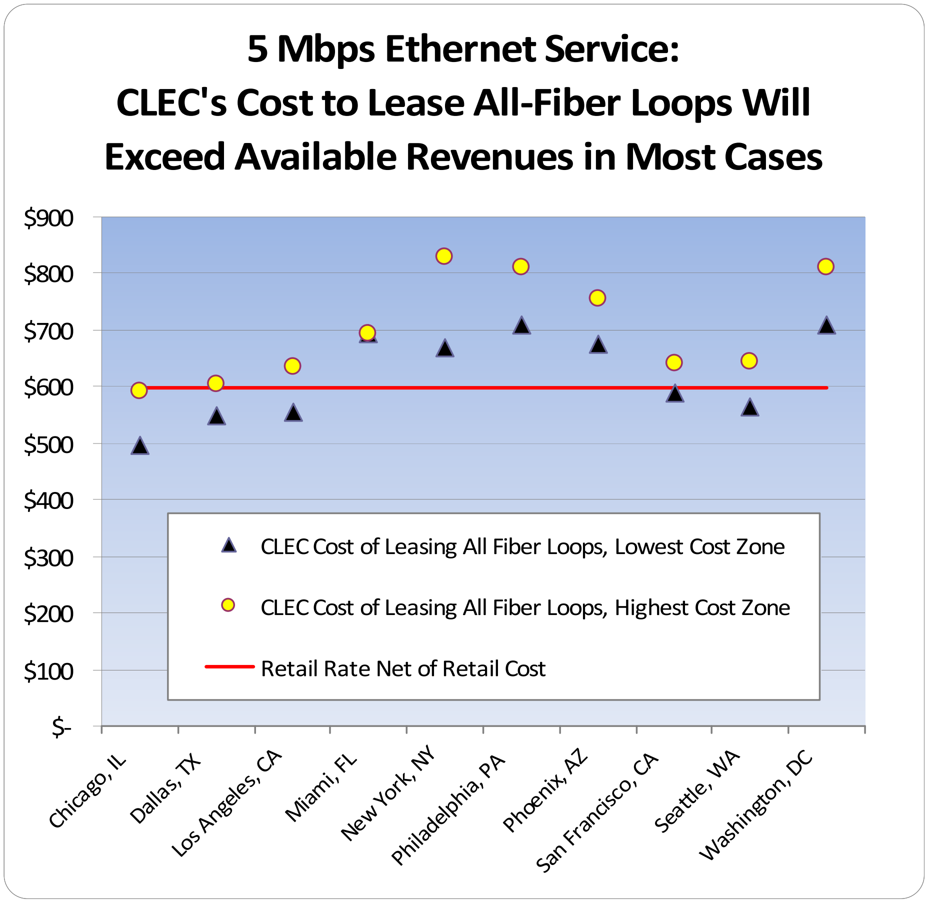
b. Summary of the Analysis and Findings

Part I: *Economic Viability of Leasing ILEC Facilities*. This part of the analysis focuses on the costs that competitive local exchange carriers ("CLECs") would incur when they *lease* ILEC facilities (UNEs, collocation, special access circuits, etc.) in order to offer broadband services. We analyze three scenarios that describe variations in the current network design:

- "All-copper" loops, i.e. the ILEC's loop facilities are provisioned entirely on copper wire pairs from the customer premises back to the serving central office ("CO");
- Various combinations of fiber feeder/copper terminus, including traditional Digital Loop Carrier ("DLC") systems and more advanced deployments such as AT&T's U-verse network; and
- All-fiber loops, e.g. Verizon's fiber-to-the-home ("FTTH") architecture underlying its FiOS offerings.

We look at a sample of the following ten different Metropolitan Statistical Areas ("MSAs"): Chicago, Dallas, Los Angeles, Miami, New York, Philadelphia, Phoenix, San Francisco, Seattle and Washington, D.C. These ten MSAs are important markets for most CLECs that include serving territories of all three RBOCS (AT&T, Verizon and Qwest) and represent different geographic regions. We look at the cost associated with leasing ILEC loop and transport facilities necessary to provide a 5 Mbps Ethernet service – an example of service sought after by small and medium-size business. For each of the ten MSAs we calculate the CLECs' cost associated with leasing facilities necessary to provide a 5 Mbps Ethernet service in three situations – all-copper, hybrid and all-fiber loops. As will be discussed, the limitations on CLECs' ability to compete more broadly stem from two interrelated factors: escalating costs (as the presence of fiber in the network means that facilities have to be leased at higher or non-UNE based prices) and/or limited availability of facilities.

We found, as show in the chart below, that CLECs will confront a price squeeze in the aforementioned ten MSAs when they need to serve business customers by ILEC-leased all-fiber loops, i.e. in locations where copper loops are either not available or not available in the necessary numbers of wire pairs to maintain service speeds over larger distances. Specifically, of the twenty scenarios that we examined (ten MSAs, with lowest cost zone vs. highest cost zone for each), we found clear evidence of a price squeeze – even before all of the CLECs' internal costs for electronics, sales, overhead, etc. are taken into account – in fourteen cases, including all zones for Miami, New York City, Philadelphia, Phoenix, and Washington, D.C., and the highest cost zone scenarios for Dallas, Los Angeles, San Francisco, and Seattle.



Even in the remaining six cases, the gap between retail price and lease cost is under $50, with the exception of one case (in Chicago). Given all of the other costs that a CLEC would incur to provide 5 Mbps broadband service over the leased ILEC all-fiber loops (such as the CLEC's own electronics, IP network, operations, installation, and general and administrative costs), it is manifestly unlikely that a CLEC would be able to realize a significant profit in those six cases as well. Thus, the results show that CLECs that are dependent on ILEC "last-mile" distribution facilities are effectively foreclosed from widespread provision of competitive broadband services under the FCC's existing "closed" approach (as opposed to open access) to ILEC broadband networks.

Part II: *Economic Viability of CLEC Self-Provisioning Facilities*. Part II of our analysis examines whether self-provisioning of loop and transport fiber-optic facilities for the provision broadband services is an economically viable option. Importantly, our analysis is an incremental one in which we assume that CLECs already own and operate metropolitan fiber optic rings and we, therefore, attribute only a proportionate share of the ring cost to Ethernet services. [4] This means that a CLEC would be able to use its already existing metropolitan fiber ring (assuming there is usable spare capacity that can be activated) and central office facilities and needs to *newly construct* only a "*fiber lateral*" (a relatively short loop or/and transport segment that connects the existing fiber ring to the target end-user

[4] While this assumption is true for many CLECs, it is not for all CLECs, as a good number of them do not own fiber optic facilities.

customers) to provide Ethernet-based broadband services to multiple customers. As such, our analysis is narrowly constructed to consider only the *incremental costs* and *incremental revenues* associated with serving those new customers.

Further, we have focused our analysis on the small to medium size business customers, the traditional target group for many CLECs, to explain why CLECs in many instances are unable to compete for the provision of broadband services to that market segment without access to ILEC last mile facilities. Specifically, we have considered the incremental costs and revenues associated with offering a 10 Mbps Ethernet service under varying input assumptions: number of customers served (1 though 32)[5]; fiber costs (Low: $3, Medium: $26, High: $50)[6], distance (0.5, 1, 2, and 5 miles). Depending on these input assumptions, a large number of situations were considered to determine when CLECs could self-provision facilities to viably serve customers they cannot otherwise serve by means of facilities leased from the ILECs. We also examined 5 Mbps and 20 Mbps Ethernet services, with monthly revenues of $720 and $1,520 respectively. While we did not perform as detailed a cost/benefit analysis for 5 Mbps and 20 Mbps speeds, our review of the data confirms that the results are generally comparable to those we report for the 10 Mbps Ethernet service.

The two charts below summarize our analysis by comparing the average *incremental* revenues and the incremental costs associated with Ethernet service under varying assumptions. The average incremental revenue value, $826 per customer per month, represents the current market price for 10 Mbps Ethernet service ($995), adjusted to remove revenues associated with retailing activities.[7] Note that the incremental costs reflect only (a) the costs of the newly constructed fiber laterals and (b) the costs of expanding capacity of an already existing fiber ring and central office facilities. Not reflected are the costs of the core network needed to establish connectivity with other customers, carriers and networks.[8] Therefore, *the charts delineate circumstances under which CLECs definitely <u>cannot</u> viably construct their own facilities*. In the very limited set of circumstances in which our analysis show positive margins (which occurs only when CLECs are ensured to serve large number of customers in concentrated locations), the question remains whether those margins are sufficient to cover other costs so as to allow CLECs to operate profitably.

The first chart captures how the *average* incremental costs of serving an Ethernet customer off newly constructed facilities (fiber lateral and expanded capacity of the fiber ring) decline as the CLECs is able to serve more of such customers. The chart shows that CLECs are generally unable to viably construct and operate their own facilities except under very favorable circumstances, such as when a large number of customers are located at extremely short distances from an already existing metropolitan fiber ring.

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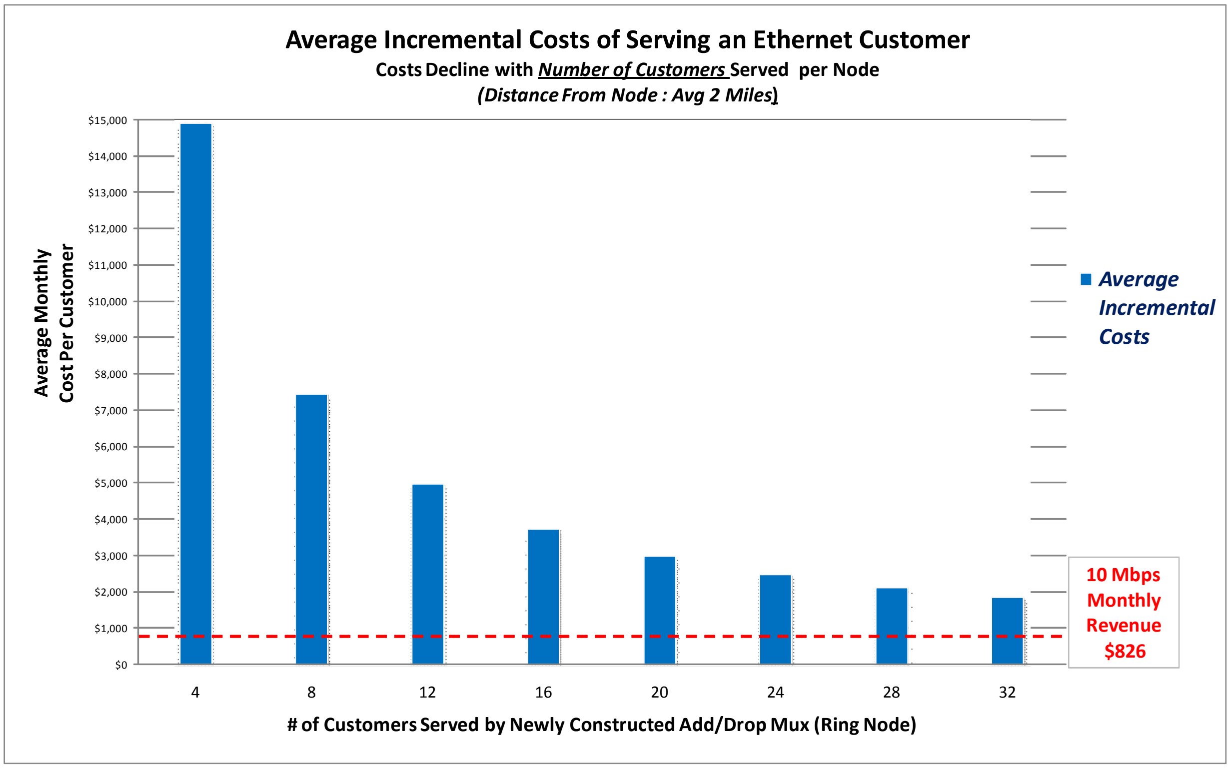
[5] As will be explained below, we assume a Cisco ONS 15454 Terminal Node and a Cisco ONS 15454 Add/Drop (Ring) Node that can serve four fiber laterals, each with up to eight customers, making for a total of 32 customers.

[6] Our own experience is that fiber costs vary greatly based on such variables as structure costs and cable size. For purposes of this study, we have based our cost estimates for low, average, and high end estimates for urban areas on data found in Bill and Melinda Gates Foundation, Preliminary Cost Estimates on Connecting Anchor Institutions to Fiber, September 25, 2009 (filed with Notice of Ex Parte Presentation - GN Docket 09-51, October 5, 2009). Hereafter, we refer to this as the "Gates Foundation Study." The numbers comport with results reported in a publically available Qwest study: see Minnesota PUC Docket No. P-421/AM-06-713, *In the Matter of Qwest Corporation's Application for Commission Review of TELRIC Rates Pursuant to 47 U.S.C § 251*, Qwest's May 25, 2006 filing, Attachment 2, Hicap Loops Model, file MN Loop HICAP Results.xls (Public). Hereafter we refer to this as the "Qwest Loop Cost Study"

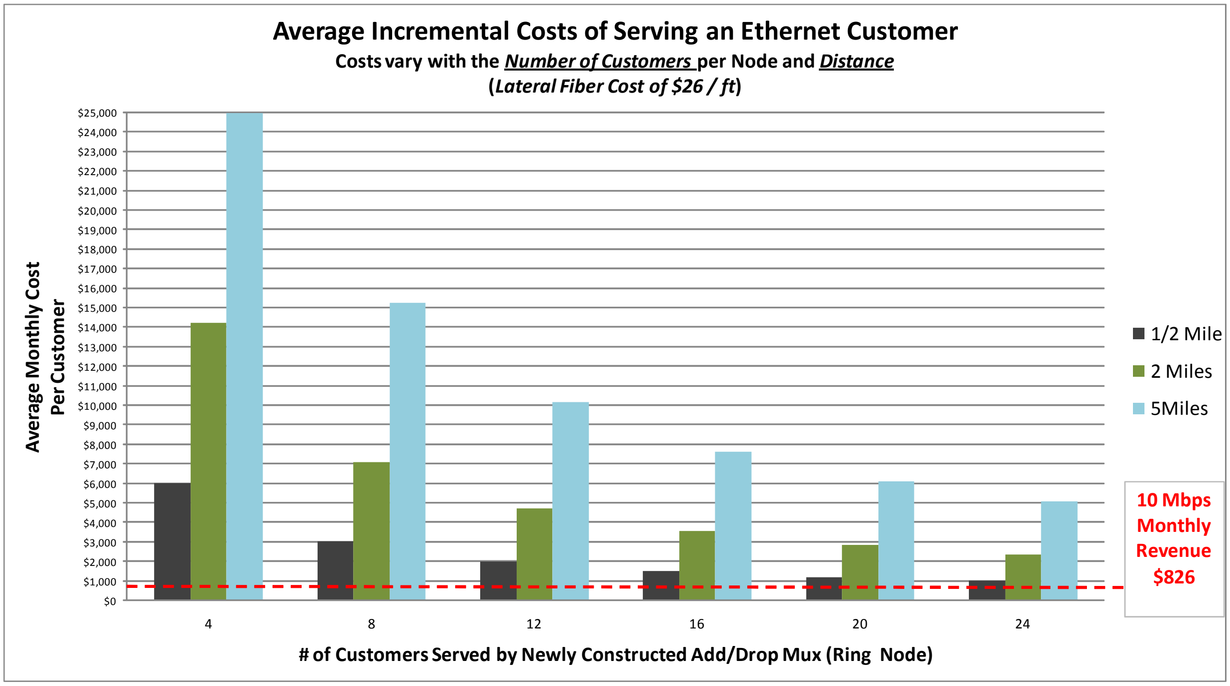
[7] This adjustment is for retail related expenses (of 17%) and explained in more detail on page 19 and 33 below.

[8] As will be discussed, we do apply a mark up for ordinary shared and common costs.



The second chart reflects more clearly how the average incremental costs of serving additional customers vary with not just with the *number of customers* but also with *distance* (0.5, 2, and 5 miles).[9] The chart shows, again, that CLECs are generally unable to viably construct and operate their own facilities except under very favorable circumstances where a large number of customers (over 24) are located at very short distances (0.5 miles or less) from an already existing metropolitan fiber ring.

[9] It is important to note that distance reflects not an airline distance but rather route distance, as determined by structures (in urban areas, mostly conduit).



To further underscore how limited the situations are in which CLECs can viably self-provision facilities, we also discuss a number of other, non-cost related limitations, stemming from such issues as time delays associated with planning and construction, lack of available conduit space, etc. We conclude that, under a wide range of demand conditions and input cost variations, self-provisioning in this manner would be cost-prohibitive and economically non-viable, in large part due to the relatively high fixed cost of the incremental broadband facilities that would be required.

In sum, Part I and Part II of our analysis both demonstrate why there is such an observed lack of competition for small and medium size business customers. We conclude that the promotion of broadband competition in the United States will be greatly advanced if the FCC takes affirmative steps to (1) guarantee continued access to the ILECs' legacy copper networks and (2) mandate access to the ILECs' emerging fiber-based broadband networks, both in terms of facilities and bit streams.

II. BRIEF OVERVIEW OF THE FCC'S BROADBAND FORBEARANCE POLICIES AND THEIR IMPACT ON CLECS

a. ILEC Unbundling and the Line Sharing Regime

When the landmark *Telecommunications Act of 1996* was passed,[10] it promised to usher in a new era of telecommunications competition in the U.S., founded in part on applying open access principles to the ILECs' local exchange networks. Three years later, the FCC established a significant new unbundling

[10] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 ("the *Act*").

requirement, "line sharing," to facilitate competitive provision of DSL services for Internet access.[11] Once the FCC established its line sharing regime, CLECs made rapid gains in the Internet access services marketplace, increasing the range of broadband service options available to mass-market residential and business customers and putting competitive pressure on the ILECs to follow suit. In January 2001, the FCC issued a reconsideration order that reaffirmed its commitment to line sharing as a vehicle to support competitive provision of Internet access services.[12]

b. Court Reversals and the Triennial Review

However, the progress of broadband unbundling in the U.S. was soon to change, as the ILECs' concerted legal challenges to the FCC's unbundling rules began to succeed. The judicial review of the *Local Competition Order* and related FCC unbundling rules is a complex story that is well beyond the scope of this paper. Most relevant here is that, after a series of federal circuit court rulings and appeals that ultimately resulted in review by the Supreme Court,[13] much of the FCC's implementation of the Act's Section 251 unbundling requirements survived, but the FCC had to revisit the conditions under which unbundled access could be considered sufficiently "necessary" to undertake.

The *UNE Remand Order* that the FCC issued in response to the Supreme Court *Iowa Utilities Board* decision reinterpreted the Act's unbundling requirements to place them "within the larger statutory framework of the 1996 Act,"[14] including "the extent to which the unbundling obligations we adopt will encourage the development of facilities-based competition by competitive LECs, and innovation and investment by both incumbent LECs and competitive LECs, especially for the provision of advanced services."[15]

Foreshadowing its subsequent change in course, the FCC declined to require ILECs to unbundle their packet switching capabilities, after concluding that such unbundling might reduce ILEC investments in broadband infrastructure and thus conflict with "our overriding objective, consistent with the congressional directive in section 706 [of the *Telecommunications Act*] …to ensure that advanced

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11 *Deployment of Wireline Services Offering Telecommunications Capability and Implementation of the Local Competition Provisions of the Telecommunications Act of 1996*, Third Report and Order in CC Docket No. 98- 147, Fourth Report and Order in CC Docket No. 96-98, 14 FCC Rcd 20912 (1999) (*Line Sharing Order*). "Line sharing" refers to unbundling the high-frequency portion of the local loop's transmission bandwidth from the low-frequency voice band, and making it available to support competitors' Digital Subscriber Line ("DSL") services.

12 *Deployment of Wireline Services Offering Advanced Telecommunications Capability and Implementation of the Local Competition Provisions of the Telecommunications Act of 1996,* CC Docket Nos. 98-147 and 96-98, Third Report And Order on Reconsideration in CC Docket No. 98-147, Fourth Report and Order on Reconsideration in CC Docket No. 96-98, et al (*Line Sharing Reconsideration Order*).

13 *AT&T v. Iowa Utils. Bd.*, 119 S. Ct. 721, 734-36 (1999) (*Iowa Utils. Bd.*). A second Supreme Court ruling in 2002, *Verizon*, 535 U.S. 467, upheld the FCC's "TELRIC" rules for determining cost-based rates for unbundled network elements (UNEs).

14 *Implementation of the Local Competition Provisions of the Telecommunications Act of 1996*, CC Docket No. 96-98, Third Report and Order and Fourth Further Notice of Proposed Rulemaking, 15 FCC Rcd 3696, 3699, (1999) (*UNE Remand Order*), at para. 2.

15 *Id.*, at para. 15.

services are deployed on a timely basis to all Americans." The *UNE Remand Order* also committed the FCC to a full review of its unbundling policy and rules in three years' time.

The "triennial review" proceeding spanning 2001-2003 proved to be highly contentious, and brought into open view deep divisions within the FCC concerning the future of its unbundling initiatives. By the time that the *Triennial Review Order* was released in August 2003, the FCC's majority opinion placed a strong emphasis on Section 706 and a heavy reliance on intermodal, facilities-based competition, principally from cable systems and wireless services, as the chief means to spur deployment of broadband-based advanced services. Intramodal competition, i.e. competitive entry based on unbundled access to ILEC networks, took a backseat, with high priority afforded to ensuring that unbundling requirements would not reduce ILECs' economic incentives to deploy their own broadband facilities. Thus the *Triennial Review Order* significantly curtailed competitive access to the ILECs' facilities for broadband services, finding that ILECs did not have Section 251 obligations to unbundle: (1) fiber-to-the-home ("FTTH"), or more generally FTTx[16] loops in "greenfield" (new deployment) situations; (2) the broadband capabilities of FTTH loops built as overbuilds to existing voice loops,; or (3) their packet-switching capabilities, including those of hybrid fiber-copper ("HFC") loops.[17] The *Triennial Review Order* also declined to reinstitute line sharing, after the D.C. Circuit Court had vacated the *Line Sharing Order* in September 2002.[18]

In 2004, the FCC issued follow-up decisions to the *Triennial Review Order* that scaled back its broadband-related unbundling requirements even further. The FCC first eliminated unbundling for ILEC fiber facilities to apartment buildings and other multiple dwelling units ("MDUs") in its *MDU Reconsideration Order.*[19] It then eliminated unbundling for ILEC fiber-to-the-curb ("FTTC") loops.[20]

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[16] In FTTx, the "x" stands for various possible locations, such as the remote terminal, curb, premises, home.

[17] *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket Nos. 01-338, 96-98, 98-147, Report and Order and Order on Remand and Further Notice of Proposed Rulemaking, 18 FCC Rcd 16978 (2003) (*Triennial Review Order*), at paras. 272-295.

[18] See *USTA v. FCC*, No. 00-1012, Order (D.C. Cir. Sept. 4, 2002) (USTA, 290 F.3d 415). The D.C. Circuit Court subsequently vacated and remanded portions of the *Triennial Review Order*, but the resulting FCC order on remand did not address issues directly related to broadband open access. See *United States Telecom Ass'n v. FCC*, 359 F.3d 554, 564-93 (D.C. Cir. 2004) (*USTA II*), *cert. denied*, 543 U.S. 925 (2004), *on remand*, *Unbundled Access to Network Elements, Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, WC Docket No. 04-313, CC Docket No. 01-338, Order on Remand, 20 FCC Rcd 2533, 2541, para. 12 (2004) (*Triennial Review Remand Order*).

[19] *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket Nos. 01-338, 96-98, 98-147, Order on Reconsideration, FCC 04-191 (rel. Aug. 9, 2004) (*MDU Reconsideration Order*).

[20] *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket Nos. 01-338, 96-98, 98-147, Order on Reconsideration, FCC 04-248 (rel. Oct. 14, 2004), 19 FCC Rcd 20293 (*FTTC Reconsideration Order*). Therein, the FCC defined "an FTTC loop" as a fiber facility connecting to copper distribution plant that is 500 feet or less from the customer's premises. See *id.* at para. 10.

c. Regulatory Forbearance and Continued Retreat from Broadband Unbundling

The same year, the FCC began applying a new vehicle, regulatory forbearance,[21] to further reduce the ILECs' broadband unbundling obligations, notably those of the Bell Operating Companies ("BOCs"). In the *Section 271 Broadband Unbundling Order*, the FCC granted the BOCs' petitions to forbear from the Section 271 obligations that had specifically applied to the BOCs relative to broadband unbundling, thereby curtailing competitive access to the same degree as the *Triennial Review Order* had for ILECs generally.[22] In December 2004, Verizon petitioned the FCC for a grant of forbearance from certain long-standing regulatory requirements to the extent they applied to its broadband services.[23] The FCC took no action on Verizon's petition, and by operation of law (which prescribed that such a petition would be granted after a certain time period if the FCC did not make a ruling by that time) it was granted in March 2006.[24] Subsequently other major ILECs sought similar forbearance for their broadband services, which the FCC granted to AT&T (along with the legacy BellSouth operating companies),[25] and then to the ILECs Embarq, Frontier, and Citizens, all in the same month (October 2007).[26] In these decisions, the FCC granted forbearance from dominant carrier regulation, tariffing and cost support requirements, and certain *Computer Inquiry* regulations for those ILECs' existing packet switching and optical (i.e., non-TDM) broadband transmission services, but it declined to remove them from Title II regulation (i.e., classification as "telecommunications services") and associated common carriage requirements.[27]

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[21] Forbearance refers to the FCC's ability pursuant to Section 10 of the Act to refrain from applying particular regulations under certain specified conditions.

[22] *Petition for Forbearance of the Verizon Telephone Companies Pursuant to 47 U.S.C. § 160(c); SBC Communications Inc.'s Petition for Forbearance Under 47 U.S.C. § 160(c); Qwest Communications International Inc. Petition for Forbearance Under 47 U.S.C. § 160(c); BellSouth Telecommunications, Inc. Petition for Forbearance Under 47 U.S.C. § 160(c)*, WC Docket Nos. 01-338, 03-235, 03-260, 04-48, Memorandum Opinion and Order, 19 FCC Rcd 21496 (2004) (*Section 271 Broadband Forbearance Order*), aff'd, EarthLink, Inc. v. FCC, 462 F.3d 1 (D.C. Cir. 2006) (EarthLink v. FCC).

[23] *Petition of the Verizon Telephone Companies for Forbearance*, WC Docket No. 04-440 (filed Dec. 20, 2004) (*Verizon Forbearance Petition*). The *Verizon Forbearance Petition* sought forbearance from Title II of the Communications Act of 1934 and the Commission's *Computer Inquiry II* rules as they pertained to its broadband services.

[24] "Verizon Telephone Companies' Petition for Forbearance from Title II and Computer Inquiry Rules with Respect to their Broadband Services Is Granted by Operation of Law," WC Docket No. 04-440, News Release (rel. Mar. 20, 2006).

[25] *Petition of AT&T Inc. for Forbearance Under 47 U.S.C. § 160(c) from Title II and Computer Inquiry Rules with Respect to Its Broadband Services; Petition of BellSouth Corporation for Forbearance Under Section 47 U.S.C. § 160(c) from Title II and Computer Inquiry Rules with Respect to Its Broadband Services*, WC Docket No. 06-125, Memorandum Opinion and Order, FCC 07-180 (rel. Oct. 12, 2007) (*AT&T Title II and Computer Inquiry Forbearance Order*) *pets. for review pending*, Nos. 07-1426, 07-1427, 07-1429, 07-1430, 07-1431, and 07-1432 (D.C. Cir. filed Oct. 22, 2007).

[26] *Petition of the Embarq Local Operating Companies for Forbearance Under 47 U.S.C. § 160(c) from Application of Computer Inquiry and Certain Title II Common-Carriage Requirements; Petition of the Frontier and Citizens ILECs for Forbearance Under Section 47 U.S.C. § 160(c) from Title II and Computer Inquiry Rules with Respect to Their Broadband Services*, WC Docket No. 06-147, Memorandum Opinion and Order, FCC 07-184 (rel. Oct. 24, 2007) (*Embarq-Frontier-Citizens Title II and Computer Inquiry Forbearance Order*).

[27] See, e.g., *AT&T Title II and Computer Inquiry Forbearance Order* at para. 12 (forbearance scope), paras. 53-58 (Computer Inquiry forbearance), and para. 67 (Title II retention).

However, in a separate decision released in September 2005, the FCC did remove from Title II regulation and *Computer Inquiry* requirements all facilities-based broadband Internet access services offered by ILECs and other wireline carriers, reclassifying those services as "information services,"[28] to put them on par with its prior decision to classify cable modem service in the same manner.[29] A key consequence of this order is that "[f]acilities-based wireline broadband Internet access service providers are no longer required to separate out and offer the wireline broadband transmission component (i.e., transmission in excess of 200 kilobits per second (kbps) in at least one direction) of wireline broadband Internet access services as a stand-alone telecommunications service under Title II…"[30]

When this series of FCC decisions from the *Triennial Review Order* onward are considered in combination, it is clear that at this point the CLECs have largely been closed off from the ILECs' broadband network capabilities, both in terms of access to facilities and to bit streams, with the exception of copper loops.

d. CLEC Use of the ILECs' Copper Infrastructure for Provision of Competitive Broadband Services

As the FCC eliminated competitive access to more and more broadband-related capabilities and functions of the ILEC networks, CLECs wishing to leverage the ILEC networks to provide competitive broadband services focused on the ILEC infrastructure that continued to be available, particularly the ILECs' copper local distribution facilities. As business customers increasingly turn to Ethernet-based communications services to link their Ethernet local area networks ("LANs"),[31] CLECs have been responding by developing broadband offerings based on Ethernet Over Copper ("EoC"), Ethernet Over DS1, and Ethernet Over BSDSL technologies. Bonding multiple copper loops into a single high-capacity data path has permitted CLECs to offer so-called "Mid-Band" EoC services with symmetrical (i.e., the same upload and download) speeds in the 2 to 10 Mbps range and higher. These services are being marketed to small and medium business customers, filling in a significant gap in the offerings of the ILECs and cable systems, between the less-expensive, but lower-speed/less-reliable mass-market

[28] *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, CC Docket No. 02-33, Report and Order and Notice of Proposed Rulemaking, 20 FCC Rcd 14853 (2005) (*Wireline Broadband Internet Access Services Order*), aff'd, Time Warner Telecom v. FCC, No. 05-4769 (and consolidated cases) (3rd Cir. Oct. 16, 2007) (Time Warner Telecom v. FCC).

[29] The FCC had issued a Declaratory Ruling that cable modem service was an information service in March 2002, but it took another three years before related legal challenges were resolved by the Supreme Court. See *National Cable & Telecommunications Ass'n v. Brand X Internet Services*, 125 S. Ct. 2688 (2005) *(NCTA v. Brand X), aff'g Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, Internet Over Cable Declaratory Ruling, Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities*, GN Docket No. 00-185 & CS Docket No. 02-52, Declaratory Ruling and Notice of Proposed Rulemaking, 17 FCC Rcd 4798 (2002) (*Cable Modem Declaratory Ruling and NPRM*).

[30] *Broadband Internet Access Services Order*, at para. 5. The FCC had established a one-year transition period, now expired, before fully implementing this provision.

[31] See, e.g., Infonetics Research, "Ethernet and IP MPLS VPN services growing in the face of downturn," August 4, 2009 (downloaded from http://www.infonetics.com/pr/2009/Ethernet-IP-MPLS-VPN-Services-Market-Research-Highlights.asp on 11/11/09).

oriented DSL and cable modem services at the low end, and the very expensive, guaranteed bandwidth DS3-based and Metro Ethernet services offered to large business customers under Service Level Agreements, at the high end. While, according to the *Berkman Study*, the United States performs well in the availability and affordability of lower bit rate broadband services, it is the lack of available alternatives and competitive pressures that cause us to underperform relative to other OECD countries in the medium and higher bit rate services.

Critical as the EoC strategy may be for CLECs in offering broadband services, CLECs continue to face several obstacles. First, as the ILECs continue their efforts to push their fiber deployments out closer to end users, via fiber-to-the-curb ("FTTC") and FTTP architectures, they have reduced the availability of copper loops running back to the central office.[32] Although the distribution portions of those loops may remain on copper and in theory could be purchased on an unbundled basis, the economic reality is that accessing them at the ILECs' remote terminals ("RTs") is almost always economically infeasible, because the high costs of collocating the CLECs' DSLAMs at the RT (as well as the transport required from the RT) cannot be spread across a sufficiently large customer base, in contrast to what can be achieved at the higher level of aggregation occurring upstream at the ILEC central office. Moreover, CLECs that opt to pursue EoC strategies rely on the ILECs' copper facilities and, just as importantly, regulatory protections to bar the ILECs from unilaterally retiring their copper loop plant, for which ILECs may have ample incentive as they upgrade to fiber

[32] See, e.g. Verizon, Short Term Public Notice of Network Change under FCC Rule 51.333(a), Replacing Copper Feeder Facilities with Fiber Optic Cable and Digital Loop Carrier Systems in Pennsylvania, September 21, 2009, downloaded from http://www22.verizon.com/regulatory/reg_ntw_dscl_html.html (11/12/09); AT&T Short Term Public Notice of Network Change under FCC Rule 51.333(a), ATT20090515S.1 (Copper facility replacement by DLC at Anderson, CA wire center), May 15, 2009, downloaded from http://www.att.com/gen/public-affairs?pid=3137 (11/12/09).

III. PART ONE: ECONOMIC VIABILITY OF LEASING ILEC FACILITIES

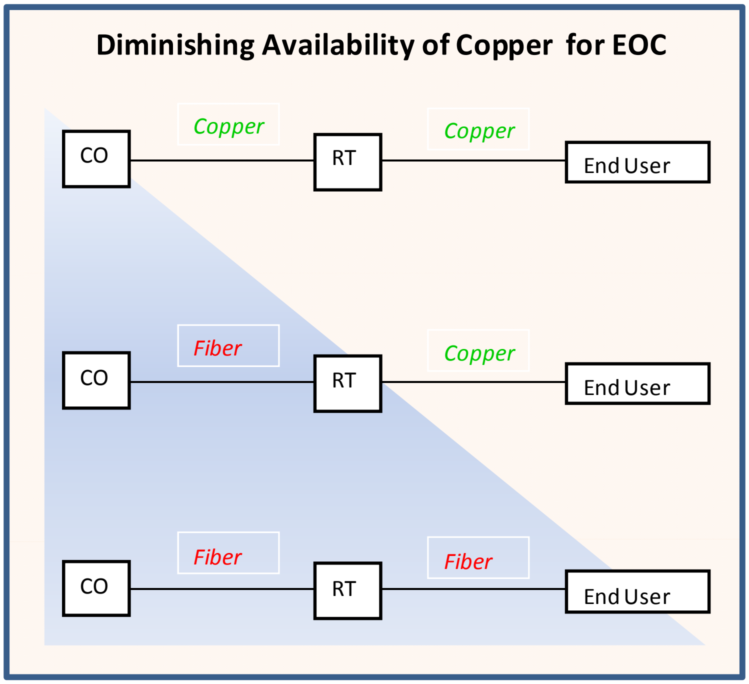
a. Overview

In order to compete effectively in broadband markets, CLECs need to be able to both offer their services to wide swaths of the broadband market and to do so on a near real-time basis, so as to meet demand for service as it materializes. While some CLECs own and operate their own fiber facilities, typically those facilities allow them to only reach a select number of larger buildings in business districts. The less than ubiquitous footprint of CLEC networks and the relatively long time lags involved in network expansions to new locations necessitates the CLECs' ongoing dependence on the ILECs' loop, collocation and transport facilities.

Against the backdrop of CLEC dependence on ILEC facilities, we assessed the CLECs' ability to compete for broadband services by examining the wholesale costs CLECs incur as they lease ILEC facilities (UNEs, collocation, special access circuits, etc.) This analysis takes into account the limited options CLECs presently have for access to ILECs' broadband networks under the broadband policy approach the FCC has pursued to date (see Section II discussion). We look at the cost of leasing local loop and transport facilities for the following three scenarios:

- "All-copper" loops, i.e. the ILEC's loop facilities are provisioned entirely on copper wire pairs from the customer premises back to the serving central office ("CO");
- Various combinations of fiber feeder/copper terminus, including traditional IDLC systems and more advanced deployments such as AT&T's U-verse network; and
- All-fiber loops, e.g. Verizon's FTTx architecture FiOS network.

The distinction between these three loop configurations is important because as a result of the FCC's TRO and TRRO orders (see Section II), CLECs have lost the ability to lease fiber loops, as well as feeder sub-loops, at cost-based (UNE) rates. The following diagram illustrates this resulting situation, by using blue shading and red font for loop segments to which CLECs no longer have access at UNE (cost-based) rates:



To illustrate the impact of the FCC's past policies on the CLECs' ability to compete, our study examines the specific example of the cost of provisioning a 5Mbps Ethernet-based broadband service via the three loop configurations listed above. The 5 Mbps bandwidth assumption is meant to represent a "Mid-band" service aimed at a market segment that is typically overlooked by ILECs and where CLECs are able to offer reasonably-priced business class guaranteed bandwidth services to business customers over bonded copper loops by utilizing Ethernet-over-copper technology.

Currently available EoC technologies allow the provider to reach speeds of up to 10 Mbps over a single copper pair on short distances and multiple bonded copper pairs as distances increase.[33] In contrast, traditional TDM-based T-1 (DS1) service offers only 1.544Mbps over a 4-wire loop. Of course, there are many situations in which copper is not available, such as greenfield (new build out) situations with all-fiber loops, as well as situations where copper facility has been retired and replaced with a fiber facility (including hybrid loops). Under the FCC's current policy and rules, CLECs do not have the ability to lease lit or dark fiber loops at cost-based (UNE) rates. Therefore, in order to provide broadband service on non-copper loops, CLECs only option (other than building their own facilities, which can be economically infeasible due to lag times of deploying facilities and/or extremely high capital expenditures) is to lease fiber facilities as an ILEC special access service, i.e. at prices that are not cost-based and that significantly exceed the cost of the analogous UNE products.[34]

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[33] See, for example, http://www.adtran.com/web/page/portal/Adtran/group/445, http://www.actelis.com/products/eadevices.php.

[34] See United States Government Accountability Office, Report to the Chairman, Committee on Government Reform, House of Representatives, *Telecommunications: FCC Needs to Improve Its Ability to Monitor and Determine the Extent of Competition in Dedicated Access Services*, November 2006. ("*GAO Report*") on Special Access pricing.

Our numerical example – provisioning of a 5 Mbps service over all-copper, hybrid and all-fiber loops – draws on this pricing differential between UNE and special access rates as well as additional network costs. This example also accounts for the fact that ILEC special access (and UNE) tariffs offer services, rather than access to facilities, at specific and discrete speeds (such as DS1 service at 1.544 Mbps and DS3 service at 44.736 Mbps), which do not match the bandwidth of the retail services an end-user demands, such as (in our example) 5 Mbps, thus causing excessive "breakage" and underutilization of facilities. For example, to achieve 5 Mbps of bandwidth over DS1 loops, a CLEC would have to lease four DS1 loop circuits,[35] and because four DS1 circuits would provide a total of 6.176 Mbps bandwidth (1.544 times 4), a portion of DS1 capacity would be underutilized.

In this working paper, we look at a sample of the following ten different Metropolitan Statistical Areas ("MSAs"):[36] Chicago, Dallas, *Los Angeles, Miami, New York, Philadelphia, Phoenix, San Francisco, Seattle and Washington, D.C*. These ten MSAs are important markets for most CLECs and include serving territories of all three RBOCS (AT&T, Verizon and Qwest). For each of the ten MSAs we calculate CLEC cost associated with leasing ILEC loop and transport facilities necessary to provide a 5 Mbps Ethernet service in three situations – all-copper, hybrid and all-fiber loops.

In our calculation of the difference in the cost of leasing facilities to provide 5 Mbps broadband for the three loop types (all copper, all fiber and hybrid) we include the recurring and non-recurring rates for local loop and local transport circuits, as well as additional leasing costs -- the recurring and non-recurring cost of collocation in ILEC central offices and the cost of cross-connects. Not included in our calculations are costs directly incurred by the CLEC (including the cost of the CLECs' electronics and other equipment, the costs of installation, maintenance and other network operations, long-haul transport and IP network costs). Given these considerations, the costs we present can be considered conservatively low to a significant degree.

b. Results

The table below provides detailed results by MSA, with the cost presented as ranges between the lowest rate and the highest rate zones:[37]

[35] Calculated as 5 Mbps divided by 1.544 Mbps bandwidth of a DS1 circuit rounded up to the nearest whole number.

[36] We use MSA as a definition of a geographical market because special access pricing varies by MSAs.

[37] Many UNE and special access rates vary by rate zone or band. UNE zones do not match special access zones.

CLEC Monthly Cost of Leasing ILEC Local Loop and Transport Facilities to Provide 5 Mbps Broadband in Selected Metropolitan Statistical Areas*

		ALL-COPPER LOOP		ALL-FIBER LOOPS	HYBRID FIBER/COPPER LOOPS	
MSA	Zone	TRRO-Impaired Wire Centers *2-wire UNE Loops, DS3 UNE Transport*	TRRO-Non-Impaired Wire Centers *2-wire UNE Loops, DS3 Sp A Transport*	All Wire Centers *Sp A DS1 Local Channels, Sp A DS3 Transport*	TRRO-Impaired Wire Centers *DS1 UNE Loops, DS3 UNE Transport*	TRRO-Non-Impaired Wire Centers *Sp A DS1 Local Channels, Sp A DS3 Transport*
Chicago, IL	Lowest	$ 57.60	$ 67.00	$ 495.26	$ 190.19	$ 495.26
	Highest	$ 77.08	$ 92.23	$ 593.00	$ 294.59	$ 593.00
Dallas, TX	Lowest	$ 65.50	$ 89.24	$ 549.63	$ 286.46	$ 549.63
	Highest	$ 79.54	$ 106.39	$ 605.10	$ 342.15	$ 605.10
Los Angeles, CA	Lowest	$ 65.93	$ 67.46	$ 553.77	$ 326.07	$ 553.77
	Highest	$ 99.83	$ 103.32	$ 635.73	$ 542.43	$ 635.73
Miami, FL	Lowest	$ 86.47	$ 103.02	$ 694.61	$ 396.25	$ 694.61
	Highest	$ 111.75	$ 128.30	$ 694.61	$ 826.85	$ 694.61
New York, NY	Lowest	$ 71.86	$ 101.34	$ 667.31	$ 410.11	$ 667.31
	Highest	$ 87.48	$ 116.96	$ 830.42	$ 595.99	$ 830.42
Philadelphia, PA	Lowest	$ 69.98	$ 96.17	$ 708.43	$ 367.85	$ 708.43
	Highest	$ 101.22	$ 127.41	$ 811.91	$ 622.29	$ 811.91
Phoenix, AZ	Lowest	$ 63.81	$ 83.35	$ 675.84	$ 332.88	$ 675.84
	Highest	$ 118.59	$ 138.13	$ 755.84	$ 367.56	$ 755.84
San Francisco, CA	Lowest	$ 65.93	$ 67.46	$ 587.77	$ 326.07	$ 587.77
	Highest	$ 99.83	$ 103.32	$ 639.73	$ 542.43	$ 639.73
Seattle, WA	Lowest	$ 67.87	$ 88.89	$ 564.97	$ 343.45	$ 564.97
	Highest	$ 79.19	$ 100.21	$ 644.65	$ 344.33	$ 644.65
Washington, DC	Lowest	$ 71.10	$ 100.58	$ 708.43	$ 384.34	$ 708.43
	Highest	$ 71.10	$ 100.58	$ 811.91	$ 384.34	$ 811.91
Average	**Lowest**	**$ 68.61**	**$ 86.45**	**$ 620.60**	**$ 336.37**	**$ 620.60**
	Highest	**$ 92.56**	**$ 111.69**	**$ 702.29**	**$ 486.30**	**$ 702.29**

** -- Local Loop and Interoffice Transport rates assuming 10-mile transport. Excludes CLEC-own cost, such as the cost of additional electronics, installation, cost of the overlaying Internet service, sales, general and administrative. Special Access rates are collected from the ILEC federal access tariffs based on a 36-months term plans. "Lowest" and "Highest" denote lowest and highest rate zones.*

At shown in the table, CLECs' costs of leasing all-copper facilities vary from $57.60 to $118.59 per month in "TRRO impaired" wire centers (wire centers where high-capacity transport services are available at

UNE rates), and from $67.00 to $138.13 per month in "TRRO non-impaired" wire centers (wire centers where high-capacity transport services are not available at UNE rates). CLECs' current costs of leasing all-fiber facilities necessary in order to provide 5Mbps broadband service are significantly higher than the costs for all-copper loops and vary from $495.26 to $830.42 per month. Finally, CLECs' current costs of leasing hybrid loops in order to provide broadband service are also high and range between $190.19 and $826.85 in TRRO impaired wire centers, and between $495.26 and $830.42 in TRRO non-impaired wire centers.[38]

The last two rows in the above table provide the summary of MSA-level findings by presenting the aggregate average of the lowest and highest zone lease cost (averaged across the ten MSAs). They show that the CLEC cost of leasing all-fiber or hybrid loops ($620.60 to $702.29 per month) as a means of providing 5 Mbps broadband service are higher, by an order of magnitude, than the cost of leasing copper loops ($68.61 to $111.69 per month) that deliver the same speeds. It is also important to observe that the ILECs' underlying costs to provide all-fiber facilities that could support the 5 Mbps service are significantly lower than the special access rates. This observation is illustrated in the following table that compares CLEC's cost of leasing facilities associated with all fiber loops (cost based on special access offerings that are presented in the previous table) with the ILEC's underlying cost of these facilities (as measured by UNE rates):

[38] A third method of provisioning on hybrid loops (not captured in the table) is a method that requires the CLEC to collocate at remote terminals (points where the copper distribution portion of the loop ends, and the fiber feeder portion of the loop begins). Because of the additional (often uncertain / "Individual Case Basis") cost of remote collocation, this scenario is generally significantly more expensive that the two scenarios presented in the table.

Comparison of CLEC Monthly Cost of Leasing All Fiber Local Loop and Transport Facilities to Provide 5 Mbps Broadband: Currently Available Prices versus Cost-Based Prices*

MSA	Zone	Currently Available *Sp A DS1 Local Channels, Sp A DS3 Transport*	Cost-based but Not Available** *Fractional DS3 UNE Loop, DS3 or OC-3 UNE Transport*	Ratio of Currently Available to Cost-Based Prices
Chicago, IL	Lowest	$ 495.26	$ 87.25	5.68
	Highest	$ 593.00	$ 108.75	5.45
Dallas, TX	Lowest	$ 549.63	$ 115.66	4.75
	Highest	$ 605.10	$ 116.02	5.22
Los Angeles, CA	Lowest	$ 553.77	$ 105.81	5.23
	Highest	$ 635.73	$ 207.91	3.06
Miami, FL	Lowest	$ 694.61	$ 121.91	5.70
	Highest	$ 694.61	$ 121.91	5.70
New York, NY	Lowest	$ 667.31	$ 157.94	4.23
	Highest	$ 830.42	$ 157.94	5.26
Philadelphia, PA	Lowest	$ 708.43	$ 125.22	5.66
	Highest	$ 811.91	$ 125.22	6.48
Phoenix, AZ	Lowest	$ 675.84	$ 127.16	5.31
	Highest	$ 755.84	$ 148.82	5.08
San Francisco, CA	Lowest	$ 587.77	$ 105.81	5.56
	Highest	$ 639.73	$ 207.91	3.08
Seattle, WA	Lowest	$ 564.97	$ 129.08	4.38
	Highest	$ 644.65	$ 129.34	4.98
Washington, DC	Lowest	$ 708.43	$ 126.42	5.60
	Highest	$ 811.91	$ 126.42	6.42
Average Across MSAs	Lowest	$ 620.60	$ 120.23	5.16
	Highest	$ 702.29	$ 145.02	4.84

* -- *Cost based scenario for fiber loops assumes that unbundled OC-3 transport and fractional (bit-rate unbundled) DS3 are available. OC-3 unbundled transport rates are taken from the ILEC UNE tariffs/price lists at the time of TRRO (which removed this service from the list of UNE elements).*

As the above table shows CLECs' current costs of leasing all-fiber facilities necessary in order to provide 5Mbps broadband service (cost based on special access tariff offerings) are significantly higher than the costs for all-copper loops and vary from $495.26 to $830.42 per month. In contrast, the underlying costs of ILEC all-fiber facilities (as measured by the cost to provide 5Mbps of bandwidth over a DS3 UNE loop) are much lower and range between $87.25 and $207.91. The last column of the table shows that special access tariff offerings exceed the underlying costs of these facilities by a factor ranging from 3.06 to 6.48.

The above analysis shows that the CLEC costs of leasing all-fiber or hybrid loops ($620.60 to $702.29 per month on average across MSAs) as a means of providing 5 Mbps broadband service are higher, by an order of magnitude, than the costs of leasing copper loops ($68.61 to $111.69 per month on average across MSAs)) that deliver the same speeds, or the ILEC costs of the underlying fiber facilities ($120.23 to $145.02 per month on average across MSAs). Given that the market price of the retail broadband product such as the 5 Mbps Ethernet service is typically in the range of $600-$800 per month, and as discussed above, this cost analysis does not include numerous other cost components (such as the cost of CLECs own operations or reasonable profit), it follows that CLECs cannot economically offer broadband retail products under currently available special access rates.

The following example shows that the CLECs face a situation of a classical price squeeze, in which the costs of essential inputs to their retail service are so high relative to the prevailing retail price level that they could not generate a reasonable profit.[39] It assumes that the retail rate of a 5 Mbps broadband offering is $720.[40] It also assumes that 17% of this end-user rate is the cost of sales or retail (an assumption that utilizes the retail discount rate typical in the industry, 17%).[41] The remaining retail rate net of retail cost is $597.60. As shown in table above, the CLEC cost of leasing all-fiber or hybrid loops are between $620.60 and $702.29 per month on average across ten MSAs, depending on the applicable special access zone. Thus, because the *retail rate net of retail cost is lower than the average cost of leasing facilities* associated with all-fiber loops[42], *CLECs cannot cover their lease costs*. Similarly, if we undertake a more granular comparison and look at individual MSA level, we see that only in a minority of cases CLECs' costs of leasing local facilities associated with all-fiber loops are lower than the prevailing retail market price for the end-user products that these facilities support. This comparison of retail prices to MSA-level cost of leasing facilities to reach customers on all-fiber loops is depicted in the chart below.

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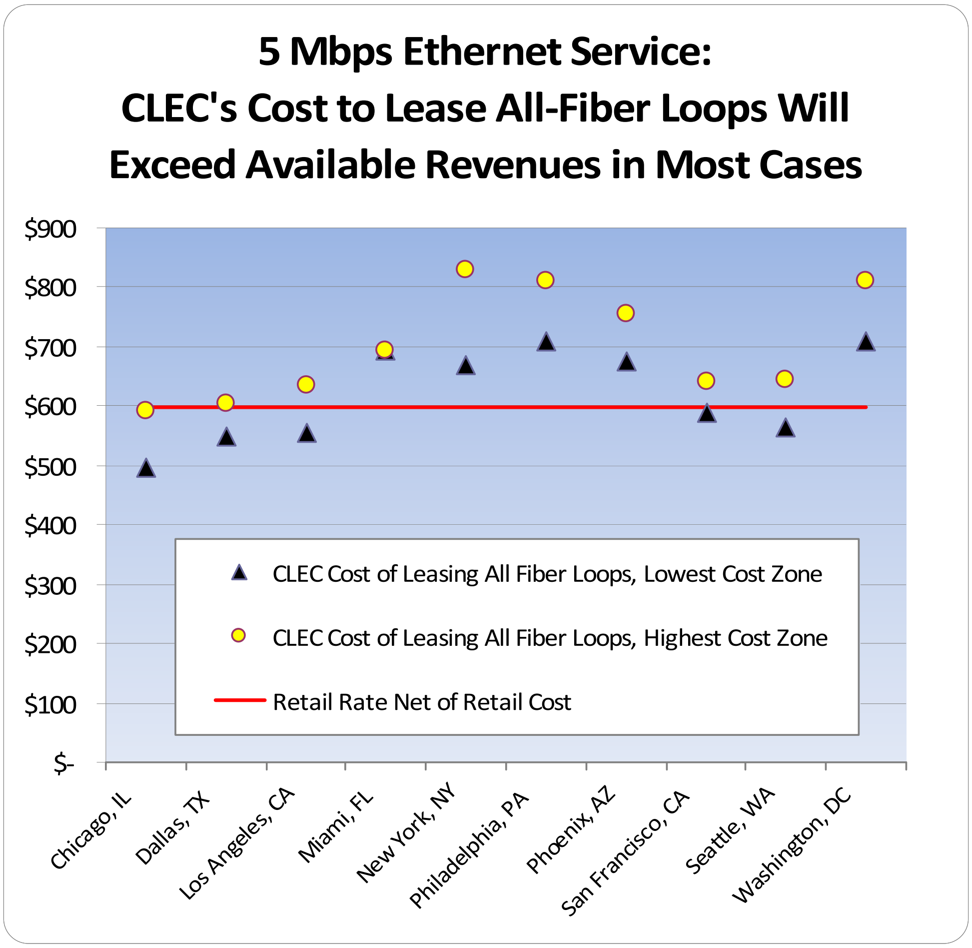
[39] See, e.g., the *Triennial Review Remand Order*, at para. 59, footnote 159, observing that "an incumbent LEC might effect a price squeeze by raising the price for the special access service (or other wholesale tariffed offering) to a level that precludes the wholesale customer from using that service to provide service in the retail telecommunications market at a price comparable to that charged by the incumbent or other market participants."

[40] This is the rate offered by Speakeasy (http://www.speakeasy.net/business/ethernet/) for 5 Mbps Ethernet service that includes 100 free e-mail accounts, Static IP and free installation and hardware.

[41] See, e.g., the AT&T-California UNE price sheet contained in the current Interconnection Agreement between Covad Communications Company and Pacific Bell.

[42] To reiterate, we have included not just the costs of the loops but also the costs of transport facilities necessary to reach end-users in the all-fiber loop scenarios.



As shown in the chart, our analysis shows clear evidence of a price squeeze – i.e., leasing costs exceeding the revenue line – in fourteen cases out of twenty, including both zones for Miami, New York City, Philadelphia, Phoenix, and Washington, D.C., and the highest cost zone scenarios for Dallas, Los Angeles, San Francisco, and Seattle. Even in the remaining six cases, the gap between retail price and lease cost is under $50, with the exception of one case (in Chicago). Given all of the other costs that a CLEC would incur to provide 5 Mbps broadband service over the leased ILEC all-fiber loops (such as the CLEC's own electronics, IP network, operations, installation, and general and administrative costs), it is manifestly unlikely that a CLEC would be able to realize a significant profit in those six cases as well. Thus, these results demonstrate that CLECs that are dependent on ILEC "last-mile" distribution facilities are effectively foreclosed from widespread provision of competitive broadband services under the FCC's existing "closed" approach to ILEC broadband networks.

IV. PART TWO: ECONOMIC VIABILITY OF CLEC SELF-PROVISIONING

a. Overview

One of the common rejoinders of the opponents of compulsory unbundling of ILEC networks is that CLECs should be able to construct their own networks without relying on ILEC facilities. In this section of our paper, we examine the incremental revenues and costs associated with offering Ethernet services (at speeds of 5 Mbps to 20 Mbps) to small and medium sized business customers to determine whether and when self-provisioning of fiber-optic facilities is a viable option in the event CLECs cannot otherwise lease facilities from the ILEC (as discussed in Part I of this paper).

Our analysis is an incremental one in which we assume that CLECs already own or have access to a core network with central office facilities and a large fiber optic ring running through a downtown area.[43] Under this assumption, CLECs would be able to expand the use of already existing ring and central office facilities and need only to *newly construct* a fiber lateral (which includes addition of a new fiber ring node) to extend their fiber-optic networks to provide Ethernet-based broadband services to multiple customers. Thus, our analysis is narrowly constructed to consider only the *incremental costs* (costs of new construction and expansion of existing network facilities) and *incremental revenues* associated with serving those new customers.

Our analysis demonstrates that, under a wide range of demand conditions and input cost variations, self-provisioning in this manner would be cost-prohibitive and economically non-viable; this result is due, in large part, to the relatively high fixed cost of the incremental broadband facilities which are recovered only when the CLEC is able to serve *a large number of customer* (upwards of 24) off a single newly constructed node (which in turn serves one to four fiber laterals).

Before we present our modeling exercise, we first discuss a number of practical considerations that may limit CLECs' ability to construct their own facilities.

b. Pragmatic Limitations to CLEC Broadband Network Build-Out

A CLEC's decision whether or not to invest in and deploy its own network facilities must, of course, take into account the economic viability of such potential deployments, i.e. whether they are likely to generate sufficient revenues to cover their costs and produce an acceptable return on the investment. However, it is equally important to consider certain practical limitations to self-provisioning as a CLEC business strategy for broadband services. Chief among those limitations is the significant time it can take a CLEC to plan, design, construct, and turn up self-provided network facilities in response to new customer demand.

i. CLEC vs. ILEC Build-Out strategies

As a threshold matter, it must be observed that obstacles to facilities build-out disproportionately impact CLECs rather than ILECs because of differences in their build-out strategies that are traceable to the ILECs' incumbency advantages: an ILEC already has a generally ubiquitous distribution network for local telephone service within its geographic service territory. When an ILEC decides to offer broadband services, it generally builds an "overlay" network, typically in an "FTTx" architecture, along the same

[43] The ownership assumption is only true for some CLECs. Many others do not own fiber rings and would have to lease access from other parties, assuming such access is available in the particular market.

routes used in its telephone network.[44] Accordingly, the ILEC is often able to take advantage of its existing network infrastructure to reduce the costs of its broadband deployment, e.g. by placing the new fiber cables along its existing telephone poles, or within its existing underground conduits. Because the lion's share of costs involved in a new fiber deployment are associated with labor-intensive construction costs, i.e. the costs of digging trenches and/or installing telephone poles and hanging the aerial cables, an ILEC's ability to avoid or reduce those costs may confer a significant cost advantage relative to what CLECs can achieve through self-provisioning.

Moreover, because of their large market share and significant financial resources, ILECs are typically able to deploy their overlay broadband networks on a market-by-market basis, *in advance of* actual customer demand. For example, Verizon has deployed its FTTP network supporting its "FiOS" services on a market-by-market basis. In any given market, Verizon deploys the fiber (and associated central office electronics) to pass essentially every home and/or small-to-medium business within the market area, *before* signing up any customers for FiOS services. Once that overlay network infrastructure is in place, Verizon proceeds to market its FiOS services, and only has to install an Optical Network Terminal ("ONT") at the customer premises and connect it to the fiber in order to start providing the service.[45]

In contrast, CLECs are almost never able to adopt such a "if we built it, they will come" strategy, and instead must attempt to get facilities in place as customer demand actually materializes. Most CLECs today have to serve new customers initially with their existing network infrastructure and/or special access facilities leased from the ILEC, and will construct new facilities only when there is a known revenue stream, from one or more customer contract commitments, that can justify those construction expenditures. In the FCC's TRRO proceeding, AT&T (then a CLEC) offered testimony explaining this point:

> AT&T and other CLECs cannot (and AT&T does not) make construction plans based on revenues they "might" earn from other customers – or even the same customer – at the same location. … As a result, each business case must be based on the specific, committed revenues made by the individual customer under each individual contract proposal.[46]

From a service provisioning and marketing perspective, this difference alone puts CLECs at a marked competitive disadvantage relative to ILECs, who usually have the ability (if not the actual wherewithal) to turn up new broadband service in a matter of days, rather than the weeks and/or months it may take a CLEC to respond to a new request for service where it does not have pre-existing spare facilities.

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[44] As noted earlier in this Report (page 9), an ILEC may also construct entirely new facilities in the case of a "greenfield" deployment to a new housing subdivision, new office complex, or the like. However, those greenfield deployments generally constitute a small fraction of the ILECs' overall broadband build-outs.

[45] See, e.g., Maryland Public Service Commission Case No. 9123, Panel Direct Testimony of Paul M. Henkelman and Edward Googe on Behalf of Verizon Maryland Inc., June 19, 2008, at pages 4-5; Verizon FiOS Internet Installation webpage, downloaded from http://www22.verizon.com/Residential/FiOSInternet/Installation/Installation.htm (December 14, 2009).

[46] *In the Matter of Unbundled Access to Network Elements and Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, WC Docket No. 04-313, CC Docket No. 01-338*, Declaration of John D'Apolito and Milford Stanley on Behalf of AT&T Corp., October 4, 2004 (D'Apolito/Stanley Declaration), at para. 11.

ii. Build-out of a Fiber Lateral

A typical CLEC that is oriented towards serving small business and business customers will have a network architecture founded upon fiber optic rings, either owned or leased, within the metropolitan areas that it wishes to serve. Because the fiber rings are designed to pass as close as possible to potential customer sites, they typically traverse public rights-of-way under city streets in the highest-density portions of the metropolitan area's commercial and business districts. The fiber optic ring provides high capacity, often SONET-based transport capacity for voice and/or data traffic between several nodes in a self-healing, protected configuration for reliability. In order to bring particular customers' traffic onto/off the ring, add/drop multiplexing equipment must be added at a node, and the CLEC must construct a fiber "lateral" transmission link out to the customer's building and install certain terminal equipment within that building. While in other situations a CLEC might be able to choose the least-cost option among placing the fiber on telephone poles ("aerial" placement), directly in a trench ("buried" placement), or in a protected underground conduit ("underground" placement), within most urban downtown commercial districts the only practical solution will be underground placement. In that case, in principle a CLEC can either install the fiber lateral in existing underground conduit space that it leases from the municipality or a utility (e.g., the ILEC or electric company), or it can independently construct the necessary conduit as well.

However, exercising the latter option creates additional obstacles that a CLEC must overcome. Before any construction can begin, the CLEC must negotiate terms with the metropolitan governmental authority that exercises control over the public rights-of-way along the proposed route for the fiber lateral. Obtaining rights-of-way access alone can take several months;[47] and once approval has been obtained, actual facilities deployment in the rights-of-way – which involves digging up roads or sidewalks, placing the conduit, and restoring the affected area – can take additional weeks or even months, especially if the municipal authority seek to minimize disruption to ordinary street and pedestrian traffic in the affected areas.[48] While the times involved will obviously vary from situation to situation, the time lags typically preclude CLECs from vying for customers that have a relatively immediate need for service.

Prior to its acquisition by SBC, when it operated as a CLEC as well as a long distance carrier, AT&T offered testimony to the FCC stating that:

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[47] In the TRRO proceeding, AT&T offered testimony that "a typical franchise agreement usually takes between four and six months to negotiate" and that "AT&T has been burdened with franchise negotiations (and accompanying litigation) that remained unresolved after many years. Further, even after a franchise agreement is reached, a municipality's ratification process can add as much as 60-90 days before construction can begin." See *In the Matter of Unbundled Access to Network Elements and Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, WC Docket No. 04-313, CC Docket No. 01-338*, Declaration Of Anthony Fea And Anthony Giovannucci On Behalf Of AT&T Corp., October 4, 2004 (Fea/Giovannucci Declaration), at para. 40.

[48] See *id.* at para. 40: "Carriers must often obtain construction permits even after rights-of-way have been obtained, and it is not uncommon for municipalities to impose construction moratoria, especially during certain times of the year, such as in Boston during the winter months and during the holiday season in New York City and other communities."

> Even under ideal conditions, it takes a minimum of twelve months for a facility to become "operationally ready" – i.e., ready to provide service to a customer or customers subtending a particular central office. Such ideal conditions include (1) prior existence of any necessary rights-of-way and no other municipal impediments to timely construction; (2) availability of space at the network node to house and power terminal equipment; (3) all construction proceeding without unforeseen delays; and (4) ready access to the customer's premises within the building. In our experience, the chances of all of these conditions being satisfied on a given route are unlikely.[49]

That being said, the alternative of leasing existing conduit space is not always a straightforward process either. First, there must be available unutilized space in the conduit(s) along the planned route for the lateral, which is not always the case. When the existing conduit space along the least-cost (typically, most-direct) route is not available, the CLEC may be forced to use a longer, less-direct routing, driving up its investment costs. In prior comments to the FCC, the former Sprint has explained that "R[ights] O[f] W[ay] and conduit exhaustion are serious problems in major business centers, including Washington and New York."[50] Sprint offered two specific examples from its own experience:

> Sprint was unable to pull its own fiber through New York's Lincoln Tunnel for two years because of lack of available space. Only after another carrier's copper cable was removed was Sprint able to proceed. In another case, Sprint was unable to bid for a major customer on Staten Island because none of Sprint's vendors were willing to bid due to the difficulties of dealing with the Port Authority for running fiber on its bridges.[51]

Moreover, a growing problem is that many local municipalities and other governmental authorities that control rights-of-way and conduit space have been raising their fees, in some cases to patently exorbitant amounts. In a complaint case pending before the FCC, Level 3 Communications has alleged that the New York State Thruway is charging it some $364 per foot on average for lateral connections to Level 3's fiber backbone along the Thruway.[52] In its Comments in that case, Qwest Communications International stated that "Qwest has also seen a dramatic up-tick in excessive right-of-way fee demands by local governments in recent years, not unlike the demands made by the NYSTA here. Level 3's petition is simply representative of a much larger, and rapidly growing, problem throughout the United States."[53] Similarly, the Verizon companies have concluded that "excessive and discriminatory fees imposed by localities for access to public rights-of-way, combined with localities' delay in acting on requests for access, threaten to inhibit the deployment of broadband facilities and to impair

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49 Fea/Giovannucci Declaration, at para. 48.

50 *In the Matter of Unbundled Access to Network Elements and Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, WC Docket No. 04-313, CC Docket No. 01-338*, Comments of Sprint Corporation, October 4, 2004, at page 44.

51 *Id.*, at page 44.

52 See FCC Docket WC 09-153, Level 3 Communications Inc., Petition For Declaratory Ruling That Certain Right-Of-Way Rents Imposed By The New York State Thruway Authority Are Preempted Under Section 253, filed July 23, 2009, at page 13.

53 WC 09-153, Comments Of Qwest Communications International Inc., October 15, 2009, at pages 1-2.

competition."[54] This trend is adversely impacting ILECs and CLECs alike, but can be a particularly acute obstacle for a CLEC attempting to build-out a fiber lateral to serve a particular customer, since the CLEC's alternatives may be few or nil, and any additional delays can further reduce the economic viability of the CLEC's self-provisioned facility.

c. Modeling the Incremental Costs of CLEC Self-Provisioning

Notwithstanding the substantial pragmatic obstacles that we have just described, most CLECs would greatly prefer to self-provision broadband facilities wherever and whenever it is economically feasible to do so, because of the inherent advantages of such ownership: greater control over network costs and reliability, more discretion with respect to the speeds, features, and other characteristics of their service offerings, and the ability to leverage those network investments via further expansion and/or technology upgrades as customer demand grows. Thus, understanding the conditions under which CLEC self-provisioning is likely to be economically feasible is a key issue, to which we now turn.

To this end, we have constructed a cost model that estimates the *incremental* costs that a CLEC would incur to (a) construct and operate one or more fiber laterals to connect new customers and (b) allocate the incremental capacity on already existing metropolitan fiber ring and central office facilities in order to provide Ethernet-based broadband service with speeds in the 5 Mbps to 20 Mbps range.[55] Also, included are, as will be discussed, shared and common cost. All incremental costs are calculated under forward-looking, least-cost technology assumptions and based on current vendor prices.

It is important to note that our cost analysis is narrowly constructed to capture only the incremental costs of extending an existing network and operation as necessary to serve an additional set of customers. Specifically, it does not include *any* costs associated with the core network that establishes connectivity with other customers, carriers and networks. Also not included are retail costs (which are accounted for in end-user prices, as discussed below).

Thus, we define "economic feasibility" in terms of the relationship between the *incremental costs* of serving additional customers and the associated *incremental revenues*, i.e. the anticipated revenues from the newly-connected customers at the prevailing market prices for the services they buy. Specifically, when the modeled incremental costs are *higher* than the anticipated customer revenues, we conclude that the lateral build-out is not economically viable; when those incremental costs are *lower* than the revenues, the build-out *may* be economically viable, but not necessarily in all situations: further examination would be required to take into account whether margins are sufficient to permit the CLEC to continue to operate profitably.

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[54] WC 09-153, Comments of Verizon and Verizon Wireless, October 15, 2009, at pages 1-2.

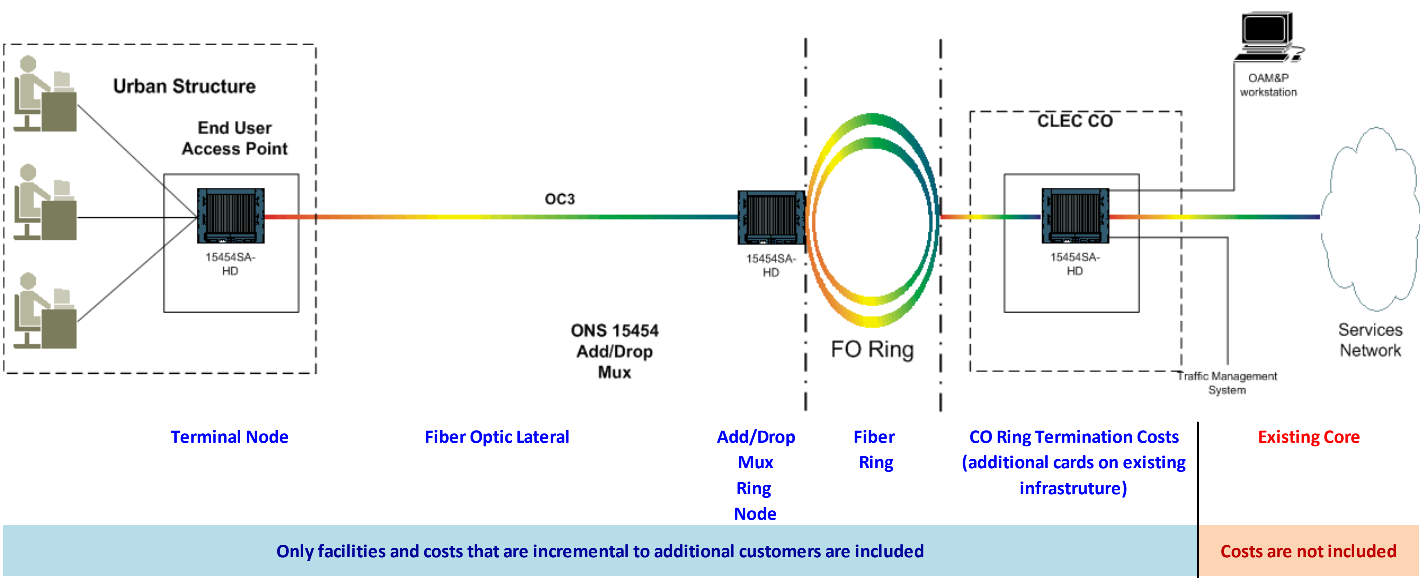
[55] The Cisco ONS 15454 technology that we chose to model is quite flexible and can support multiple carrier-designated speed tiers in this range (e.g. 5 Mbps, 10 Mbps, and 20 Mbps); as discussed below, we have focused on a 10 Mbps offering in our costs vs. revenues analyses.

Our model's results are best viewed, therefore, as identifying conditions under which CLEC self provisioning of incremental broadband facilities are *clearly not economically viable*, and thus where CLECs are effectively foreclosed from serving small and medium sized business customers.

We will further elaborate on this point in our discussion of the modeling results. But first, we discuss the structure and inputs of our model in greater detail.

i. An Incremental Cost Model for CLEC Self-Provisioning of Fiber Laterals for Ethernet-Based Broadband Services

The starting point of our analysis is an assumption that a CLEC operates or leases an existing central office and fiber ring within a metropolitan area and deploys facilities to self-provision network facilities to offer Ethernet-based broadband services to small- and medium-sized business customers within that metro area. To accomplish this task, the CLEC would typically build out one or more fiber laterals from the nearest access point on the fiber ring, to the buildings where the customers are located, with Add/Drop multiplexing equipment on the ring, a Terminal Node at the customer premises, and a fiber optic link connecting the two. Further, the CLEC would need to establish or lease capacity available on the existing fiber ring and incrementally modify central office equipment. This necessary network additions and modifications are depicted schematically in the figure below.[56]



There are numerous vendors that offer the carrier-grade electronics needed to provide Ethernet-based services using this type of configuration. For the terminal node (customer premises), ring node, and central office node, we have selected Cisco Systems, a leading provider of Ethernet-capable optical

56 As discussed below, our cost model is based on a least-cost technology choice (a Cisco ONS 15454 SA-HD Add/Drop Mux) that supports *four* laterals.

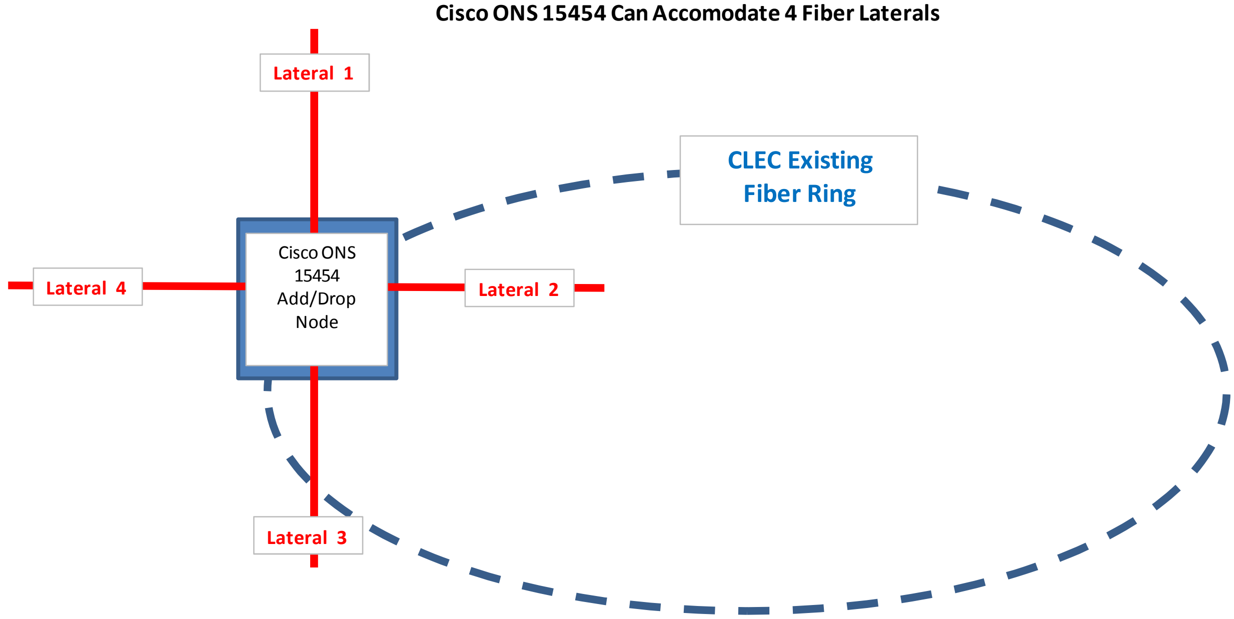
network equipment.[57] We have specified use of the Cisco ONS 15454 for the Add/Drop Mux, the Central Office Node and the Terminal Node; for each, we have identified and priced-out all of the equipment necessary to ensure fully-functioning, Ethernet-capable laterals, including the timing, communications and control module, optical cards, cross-connect cards, shelf assemblies, software licenses, and power supplies (among other items). All equipment prices were obtained directly from the vendors. We then applied a 15% discount from list price to all electronics.[58] All equipment was then subject to Sales Tax and Engineered, Furnished, and Installed ("EF&I") factors of 7.0% and 10.0%, respectively.

Further details concerning our modeling of the Add/Drop Mux, Terminal Node, Central Office Node, Fiber Optic Link and Ring expansion are discussed in turn below.

ii. Add/Drop Multiplexer – Ring Node

Because we assume the existence of an OC-48 ring, the Add/Drop Mux is specified with OC-48 cards. The Cisco ONS 15454 can support up to *four laterals* without additional cards; thus to model the least-cost configuration, our model effectively assumes that the Add/Drop Mux supports four laterals, so that the costs Add/Drop Mux is spread over customers served on all four. The diagram below depicts our assumed Add/Drop Mux with four fiber laterals.

Cisco ONS 15454 Can Accomodate 4 Fiber Laterals



[57] Given the manifestly-competitive nature of the optical networking equipment market, we would expect our cost results to be similar if we had chosen an alternative vendor for costing purposes.

[58] The level of discount achievable by CLECs in the current economic environment varies but is generally significantly smaller than what is extended to ILECs which generally purchase in much larger volumes. It is not uncommon for CLECs to receive no discounts at all, while very large ILECs may receive discounts upward of 50%.

The details of the Add/Drop Mux specification that we developed are provided in the following table.

OC 48 Add/Drop Multiplixer Located on CLEC Fiber Ring	
ONS 15454 Node	**Units**
Shelf Assembly (MSPP)	
15454-SA-HD	1
Cisco ONS 15454 High Density Shelf Assembly, NEBS 3 ANSI, High Density Electrical Capacity, Industrial Temperature Rated	
System Software License	
Release 4.6 Supplied with shelf assemblies	1
Fan-Tray	
15454-FTA3-T	1
Air Filter	
Model 15454-FTF2	1
Timing, Communications, Control	
15454-TCC2P-K9=|	2
The enhanced TCC2 card performs all the same functions as the TCC+, but also has additional features including supply voltage monitoring, support for up to 84 data communication channel/generic communication channel (DCC/GCC) terminations, and an on-card lamp test. The TCC2 is the standard processor card shipped with System Releases 4.0 to 4.6.	
Cross-Connect Card	
15454-XC-VT=	2
The XCVT establishes STS-1 and VT 1.5 connections and performs SONET TDM switching at the STS-1 level.	
Optical Cards	
15454-MRC-2.5G4	2
Provides four SONET/SDH OC-3 ports compliant with ITU-T G.707, G.957, and Telcordia GR-253.	
15454-OC48IR1310A	2
The 15454-OC48IR1310A card provides one, Telcordia-compliant, GR-253 SONET OC-48 port per card.	
Alarm Interface Controller Card	
15454-AIC-1	1
The optional Alarm Interface Controller card (AIC-I) replaces the AIC card for System Releases 3.4 and higher. It provides four main capabilities including 1) environmental alarm interconnection, 2) orderwire, 3) A- and B-side input voltage monitoring, 4) access to user data channels.	
Cisco AC/DC Power Solution	
Cisco CSCO-SM-PWR-SA	
The Cisco AC/DC Power Solution provides a scalable platform for the delivery of DC power to equipment-installation sites that have only an AC power source.	
23' Equipment Rack	
SWE570-23	1
Fuse and Alarm Panel	
DSX-FP-20	1
Hubbell STRAY24M FIBER, SPLICING	
STRAY24M	1
Q-Series 3-Panel Rackmount Fiber Optic Enclosure, 1U	
Mfr. Part#: 39101	1
Fiber Optic Terminations	12
Fiber Optic Distribution Panel	
PL8C 12 Port SC Fiber Optic 2 Unit Rackmount	1
SC/SC Plenum-Rated Duplex 9/125 Single Mode Fiber Patch Cable	8

iii. Terminal Node

The model assumes that the Terminal Node is placed at the end-user premises, perhaps in a common telco area, and has access to power and environmental protection (HVAC) as specified by the vendor. The Terminal Node is configured to handle up to eight Ethernet connections. This arrangement would permit the CLEC to offer the types of Ethernet services found in the small- to medium-business market today, e.g. 5 Mbps, 10 Mbps and 20 Mbps Ethernet service for Internet access or data communications *to up to eight customers per location*. The following table provides our specification of the Terminal Node.

Terminal Node With Access to Multiple Customers	
ONS 15454 Node	**Units**
Shelf Assembly (MSPP)	
15454-SA-HD	1
Cisco ONS 15454 High Density Shelf Assembly, NEBS 3 ANSI, High Density Electrical Capacity, Industrial Temperature Rated	
System Software License	
Release 4.6 Supplied with shelf assemblies	1
Fan-Tray 15454-FTA3-T	1
Air Filter Model 15454-FTF2	1
Timing, Communications, Control	
15454-TCC2P-K9=	2
The enhanced TCC2 card performs all the same functions as the TCC+, but also has additional features including supply voltage monitoring, support for up to 84 data communication channel/generic communication channel (DCC/GCC) terminations, and an on-card lamp test. The TCC2 is the standard processor card shipped with System Releases 4.0 to 4.6.	
Cross-Connect Card 15454-XC-VT	2
The XCVT establishes STS-1 and VT 1.5 connections and performs SONET TDM switching at the STS-1 level.	
Optical Card 15454-MRC-2.5G4	2
Provides four SONET/SDH OC-3 ports compliant with ITU-T G.707, G.957, and Telcordia GR-253.	
Alarm Interface Controller Card	
15454-AIC-1	1
The optional Alarm Interface Controller card (AIC-I) replaces the AIC card for System Releases 3.4 and higher. It provides four main capabilities including 1) environmental alarm interconnection, 2) orderwire, 3) A- and B-side input voltage monitoring, 4) access to user data channels.	
Ethernet Interface Cards 15454-CE100T-8	1
The CE-100T-8 is a Layer 1 mapper card with eight 10/100 Ethernet ports. It maps each port to a unique SONET circuit in a point-to-point configuration.	
Cisco AC/DC Power Solution CSCO-SM-PWR-SA	1
The Cisco AC/DC Power Solution provides a scalable platform for the delivery of DC power to equipment-installation sites that have only an AC power source.	
23' Equipment Rack SWE570-23	1
Fuse and Alarm Panel	
DSX-FP-20	1
Hubbell STRAY24M FIBER, SPLICING	
STRAY24M	1
Q-Series 3-Panel Rackmount Fiber Optic Enclosure, 1U	
Mfr. Part#: 39101	1
Fiber Optic Terminations	4
Fiber Optic Distribution Panel	
PL8C 12 Port SC Fiber Optic Rackmount	1
SC/SC Plenum-Rated Duplex 9/125 Single Mode Fiber Patch Cable	2
Universal Wire Minder-Kendal Howard	4
Cat. 6 UTP Bulk Cable 500ft.	1

iv. Add/Drop Multiplexer – Central Office Node

As with the Add/Drop Mux (Ring Node accommodating the newly constructed fiber lateral(s)), we assume the existence of an OC-48 ring, and establish central office connectivity by means of additional cards in an already existing Add/Drop Mux in the central office. The table below details the specifications and the incremental facilities (cards) to be added to an existing Add/Drop Mux in the central office.

OC 48 Add/Drop Multiplixer Located in Existing CLEC CO	
ONS 15454 Node	**Incremental Units**
Timing, Communications, Control	0
Cross-Connect Card	0
Optical Cards	0
15454-OC48IR1310A	2
The 15454-OC48IR1310A card provides one intermediate-range, Telcordia-compliant, GR-253 SONET OC-48 port per card.	
Alarm Interface Controller Card	0
Shelf Assembly (MSPP)	0
System Software License	0
Fan-Tray	0
Air Filter	0
23' Equipment Rack	0
Hubbell STRAY24M FIBER, SPLICING	0
Q-Series 3-Panel Rackmount Fiber Optic Enclosure, 1U	0
Fiber Optic Terminations	0
Fiber Optic Distribution Panel	0
SC/SC Plenum-Rated Duplex 9/125 Single Mode Fiber Patch Cable	0
48vdc AC/DC Switching Power Supply, PFC, Single Output,Enclosed	0

v. Fiber Optic Link Incremental Cost Drivers – Laterals and Fiber Ring

For the fiber link and ring portion of the lateral, it is not possible to develop a fixed set of specifications, as we have for the Add/Drop Mux and Terminal Node, since construction costs can vary enormously depending on the physical conditions at specific locations, the type of placement chosen (i.e. aerial, buried in trench, or underground in conduit), distance to the customer, density of the service area, and size of the fiber ring, among other factors. Therefore, we have estimated the fiber costs of the ring and the lateral for a variety of conditions, drawing on publically-available estimates of fiber investment costs on a per-foot basis, including a publically available Qwest cost study for its Minnesota service territory,[59] and the recently-published preliminary cost estimates for deployment of fiber to anchor institutions that were filed in the FCC's National Broadband Plan proceeding by the Bill and Melinda Gates Foundation.[60]

For the *fiber laterals*, there are two primary factors (variables) that determine the overall costs of fiber optic links (not considering the electronics): the per-foot fiber costs (determined, in turn, by a number of other factors, such as cable costs and structure costs), and customer's distance from the Add/Drop Mux (Ring Node). With respect to those variables, we have assumed the following:

- *<u>Per-foot fiber costs</u>*: Specifically, we have produced model results considering three input assumptions for the per-foot investment costs for fiber, assuming two fiber strands to connect the Add/Drop Mux and Terminal Node: $3.00/ft., $26.00/ft. and $50.00/ft. These are, respectively, the midpoint of the *low-end* per foot fiber deployment costs, the *midrange* and *high-end* per foot fiber deployment costs determined by the Gates Foundation for fiber deployment to anchor institutions in an urban area.[61] While we analyzed results for all three input assumptions, we report only results for the $26.00/ft estimate as our own experience indicates that this midrange figure is the most likely and realistic one to be encountered by CLECs.

- *<u>Distance Assumptions</u>*: Under each of those fiber cost assumptions, the model then develops a matrix of fiber lateral costs under scenarios that assume four customer distances: ½ mile, 1 mile, 2 miles, and 5 miles.

As will be discussed below, the model calculates costs based on various numbers of customers per location ranging from one to eight, consistent with what the technology configuration permits. As we will explain further when discussing our model results, consistent with the limited real world CLEC fiber deployment to small and medium sized business, the model finds that fiber lateral build-out by a CLEC are *not economically feasible* under most circumstances, no matter which fiber cost assumption is applied.

For the cost of establishing capacity on the already existing metropolitan *fiber optic ring*, we have used the results of the publically available Qwest loop Cost Study. The Qwest Loop Cost Study estimates the direct costs for two fiber strands running on large fiber optic rings to be $0.97/ft.[62] Further, we have assumed that the CLEC fiber ring will run twelve miles between the Add/Drop Mux – i.e., the Ring Node – and the Central Office Node.[63] As the Qwest Loop Cost Study shows, the $0.97/ft fiber cost is

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[59] Minnesota PUC Docket No. P-421/AM-06-713, *In the Matter of Qwest Corporation's Application for Commission Review of TELRIC Rates Pursuant to 47 U.S.C § 251*, Qwest's May 25, 2006 filing, Attachment 2, Hicap Loops Model, file MN Loop HICAP Results.xls (Public). Hereafter we refer to this as the "Qwest Loop Cost Study."

[60] Bill and Melinda Gates Foundation, Preliminary Cost Estimates on Connecting Anchor Institutions to Fiber, September 25, 2009 (filed with Notice of Ex Parte Presentation - GN Docket 09-51, October 5, 2009). *Hereafter, we refer to this as the "Gates Foundation Study."*

[61] Gates Foundation Study, at page 4.

[62] See Qwest Loop Cost Study at Summary tab, "2-Fibers" column.

[63] The characteristics of fiber rings vary greatly from carrier to carrier and from location to location. Having examined many ILEC studies and CLEC networks, we believe that for purposes of the current analysis it is reasonable to assume a 12 mile fiber ring.

achievable only when there is a large degree of structure sharing and the costs are allocated across all pairs in large fiber optic cables, ranging from 6 strand fibers to as high as 288 strands. Such economies of scale are not achievable for CLECs seeking to serve small clusters of small to medium size business customers. However, we nevertheless use this figure to demonstrate that even CLECs who run facilities on par with large ILECs remain foreclosed from serving small to medium size business customers, except in the rare circumstances in which they can serve large numbers of such customers (over 24 customers) in concentrated areas at close distances from their metropolitan fiber rings.

vi. Conversion to Monthly Recurring Costs and Comparison to Anticipated Revenues

Once the model determines the investment costs of the fiber lateral configuration and other network modifications and expansions, they are converted to monthly costs and compared to the monthly revenues that could be reasonably expected to be generated by the Ethernet services made possible by the lateral build-out.

Fiber investment costs are first annualized by applying an annual charge factor ("ACF") of 30.0%, to account for capital carrying costs, maintenance, and allocation of plant nonspecific expenses such as Network Engineering and Network Operations. All of the necessary electronics equipment investment costs are subject to a somewhat higher ACF, 40.0%, to reflect a shorter depreciable life than the fiber cable and to also take into account capitalized leasehold costs associated with leased floor space, power equipment required to operate the fiber electronics and the allocation of plant nonspecific expenses such as Network Engineering and Network Operations. Both of these ACFs are conservative based on our significant experience with ILEC and CLECs cost studies (which are generally confidential) , as well as ACF values available publicly.[64] Next, we need to recognize the fact that the committed revenue stream from a typical CLEC customer contract (i.e., three years) is significantly shorter than the anticipated lifespan of the lateral facility (i.e., five to seven years), and in a competitive environment the CLEC cannot be assured it will continue to receive the same level of revenues once the contract ends (either via a renewal, or potentially reusing portions of the lateral to serve other customers). We do this by applying an 85% utilization factor to the lateral investments, which we believe is probably a conservative value. Finally, we apply a factor of 35% to reflect shared and common costs of the CLEC that must be recovered from its services, although they bear no direct causal relationship to any specific service. Costs of these types include carrying costs of investment required to support the entire company such as Motor Vehicles, Furniture, Office Equipment, and Computers, as well as typical

[64] While LEC cost studies are generally confidential, AT&T (Ameritech) 1997 cost studies from Ohio UNE case 96-922-TP-UNC were recently released from confidential status by the Ohio Commission. (See http://dis.puc.state.oh.us/CaseRecord.aspx?CaseNo=96-922-TP-UNC&x=6&y=11). The ACF for electronics (Digital Pair Gain) equipment was 31.2% for the recovery of capital carrying costs and maintenance costs only. This factor did not include the supporting land and power costs. Qwest's expense and capital cost factor calculations are also publicly available. In a 2006 UNE cost case filed in Minnesota in MPUC Docket No. P-421/AM-06-713, OAH Docket No. 3-2500-17511-2, Qwest's comparable cost factor for electronics (Digital Pair Gain) equipment was approximately 47.5%. See Expense and Capital Factors - Linked 98 - MN - Prescribed ~1.xls, tabs *Capcost Results* and *Expense & Maint Factor Summary*: Capital Cost Factor (0.169182) + Maintenance Factor of 0.013563 + Network Operations Factor (0.090569) + Land Factor (0.006960) + Building Factor (0.194728).

corporate overhead costs such as Executives, Human Resources, Finance, and Information Technology.[65] The 35% value is based on our evaluation of ILEC calculations of shared and common costs as well as cost studies we have developed for CLECs.[66] It is important to note that this markup is for wholesale related shared and common costs (analogous to what is found in ILEC TELRIC studies), and does not reflect costs associated with retail related activities, such as customer acquisition, billing and collection, advertising, marketing, etc. (As described below, we account for the need of retail markup in when calculating the expected end-user revenues associated with Ethernet service, as described in the next paragraph.)

After dividing by twelve to produce monthly recurring costs, the model results can be compared to the anticipated customer revenues. We have estimated those revenues by first researching the current market prices of comparable Ethernet-based broadband services offered by CLECs.[67] We believe that a reasonable estimate of the retail market price for a 10 Mbps Ethernet offering is $995 per month. However, because our cost model does not otherwise take into account the costs of retailing functions (such as Sales & Marketing, Billing, Customer Care, etc.), in order to make an "apples-to-apples" comparison with revenues, we apply a retailing factor to remove the revenues that would go towards recovery of those retailing costs. We have applied the same 17% retailing factor here as used in Part 1 (leased facilities analysis). Thus, starting with a monthly revenue level of $995 for 10 Mbps Ethernet service, we assume a monthly anticipated revenue level of $826 per customer.

It is important to note, however, that the small- to medium-sized business Ethernet market is still emerging and evolving, and as more competitors enter the market, the available margins may decrease over time. Our model does not capture this time-sensitive aspect, which, combined with the long lag times associated with construction should further increase a CLEC's requirements for sufficient margins. Again, for that and other reasons, our analysis is fairly conservative in that it understates costs and overstates revenues, and thus is likely to depict conditions as more favorable to self-provisioning than actually experienced by CLECs.

d. Model results and their implications for the CLEC self-provisioning option

The results of our analysis are best captured in charts that can visually summarize the interactions between variables such as number of customers served, per-foot fiber costs, and distance. Specifically, the charts supplied below summarize our analysis by comparing the average incremental monthly

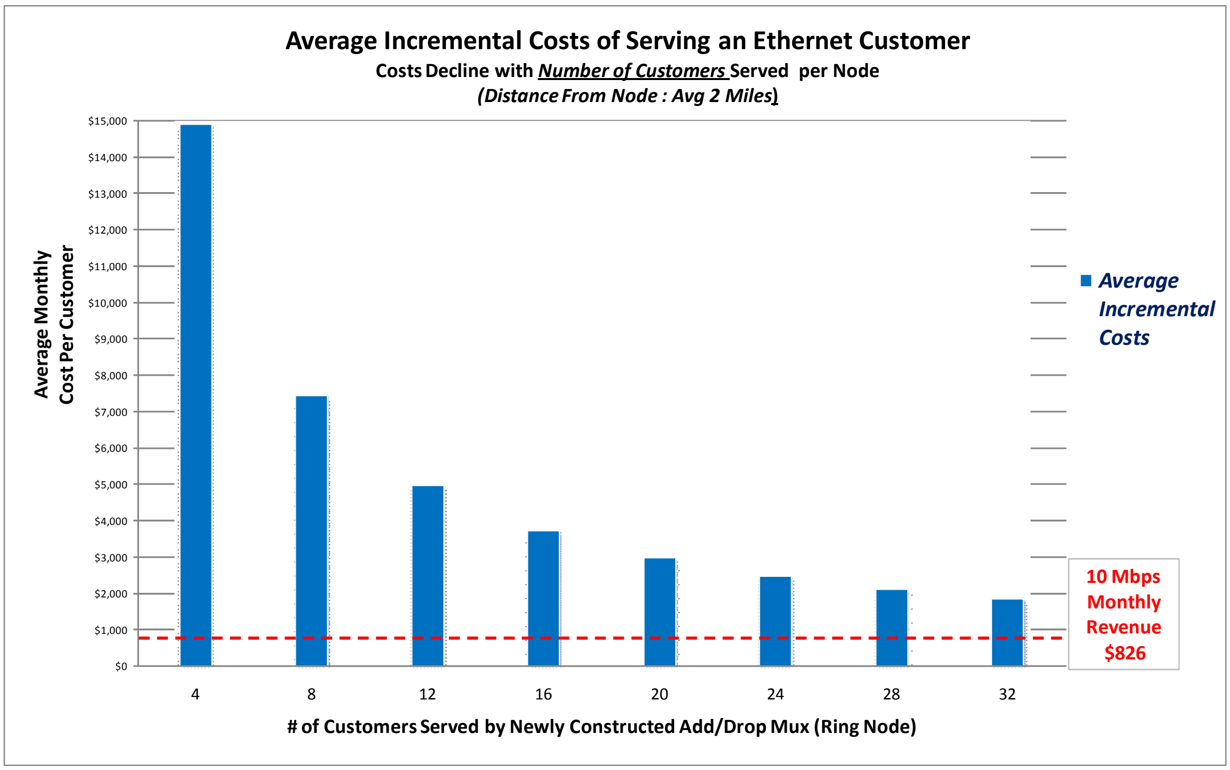
65 As explained immediately below, the costs of retailing-related functions are *not* included here.

66 For example, in the most recent SBC Ohio UNE case the Commission ordered a 27.72% shared and common factor (see Order in Case No. 02-1280-TP-UNC In the Matter of the Review of SBC Ohio's TELRIC Costs of Unbundled Network Elements (November 2, 2004) at 103).

67 For example, Speakeasy advertises Business Ethernet Services with speeds of 3, 5, 10, 15, and 20 Mbps (downloaded from http://www.speakeasy.net/business/ethernet, 12/11/2009). Note that these and other commercial Ethernet offerings have symmetrical upload and download speeds, in contrast to Asymmetrical DSL ("ADSL")-based Internet access services.

revenues[68] (i.e., price) and the average incremental monthly costs associated with Ethernet services under variations of those three input parameters. Again, the average incremental costs do not reflect *any* of the costs associated with the core network necessary to establish connectivity with other customers, carriers and networks. Therefore, *the charts only identify the circumstances under which CLECs cannot viably construct their own facilities*. In instances in which the charts show positive margins, the question remains whether those margins are sufficient to cover other costs so as to allow CLECs to operate profitably.

The first chart captures how the *average* incremental costs of serving an Ethernet customer off newly constructed facilities (fiber lateral) decline as the CLECs is able to serve more of such customers. The chart shows that CLECs are generally unable to viably construct and operate their own facilities except under very favorable circumstances, such as when a large number of customers are located at extremely short distances from an already existing metropolitan fiber ring.

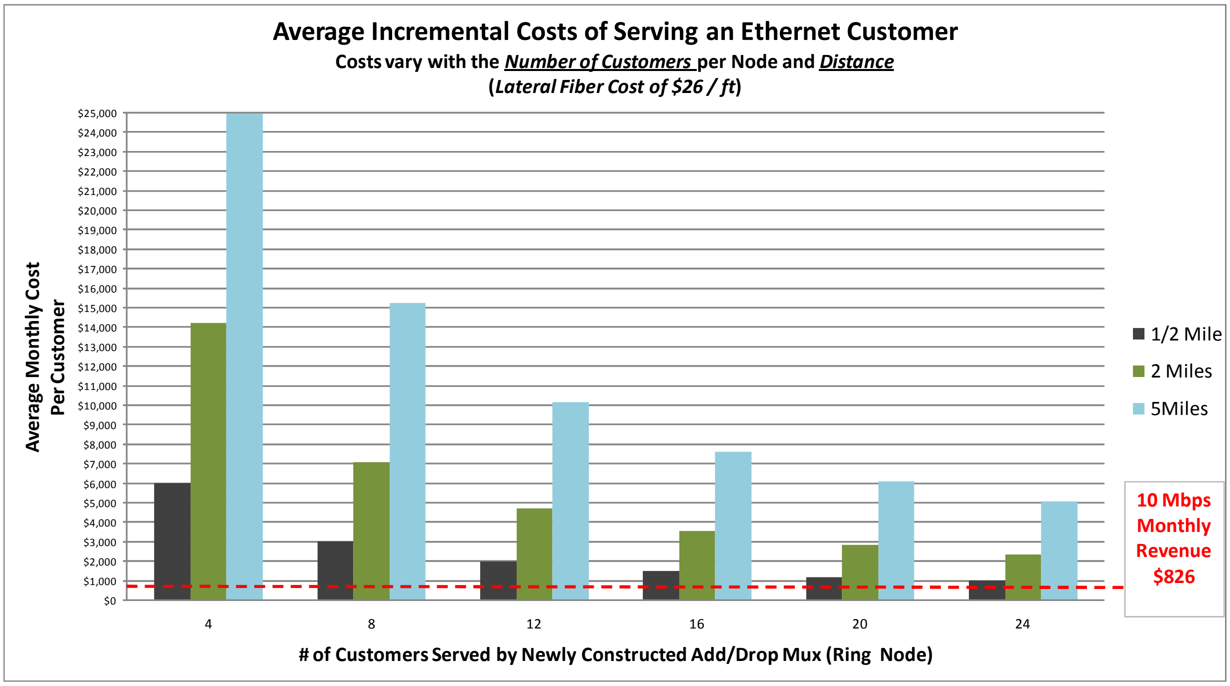


The second chart reflects more clearly how the average incremental costs of serving additional customers vary with not just with the number of customers but also with *distance* (0.5, 2, and 5 miles).[69] The chart shows, again, that CLECs are generally unable to viably construct and operate their own

[68] Our assumed monthly revenues associated with retail 5 Mbps, 10 Mbps and 20 Mbps Ethernet services are $720, $995, and $1,520.

[69] It is important to note that distance reflects not straight-line distance ("as the crow flies") but rather the distance as determined by structures (in urban areas, mostly conduit).

facilities except under very favorable circumstances when a large number of customers (upwards of 24) are located at very short distances from an already existing metropolitan fiber ring.



The same underlying information is provided in more detail in the table below. The highlighted cells mark instances in which average incremental costs exceed the average incremental revenues for a 10 Mbps Ethernet service. The table shows that for a 10 Mbps Ethernet service a CLEC will almost never be able to construct its own facilities unless it is reasonably assured to acquire no less than 28 customers, all located at very short distances (1/2 mile or less) from the existing fiber ring.

Average Incremental Costs per Ethernet Customers

Total Customers	1/2 Mile	1 Mile	2 Miles	5Miles
4	$6,045	$8,770	$14,221	$30,573
8	$3,022	$4,385	$7,110	$15,287
12	$2,015	$2,923	$4,740	$10,191
16	$1,511	$2,192	$3,555	$7,643
20	$1,209	$1,754	$2,844	$6,115
24	$1,007	$1,462	$2,370	$5,096
28	$864	$1,253	$2,032	$4,368
32	$756	$1,096	$1,778	$3,822

Indicates instances in which costs exceed expected revenue.

While the analysis indicates that there are instances in which CLECs have an incentive to build their own facilities – as we know they have done and continue to do – it also indicates that the economics of self-provisioning do not permit robust broadband competition from CLECs for small and medium sized business customers. These results should be considered in the context of the additional pragmatic factors affecting CLEC build-out capabilities (e.g., the time delays associated with planning and construction, lack of available conduit space, etc.) that we discussed earlier in this section, which further underscore how limited the situations are in which CLECs can viably self-provision facilities.

In sum, we conclude that, under a wide range of demand conditions and input cost variations, self-provisioning in this manner would be cost-prohibitive and economically non-viable, in large part due to the relatively high fixed cost of the incremental broadband facilities that would be required.

V. CONCLUSION

Part I and Part II of our analysis have identified a substantial price squeeze consistently across all of the scenarios we examined, even before all relevant costs have been explicitly factored in. This leads us to conclude that our results are robust, indicating that current market conditions and regulatory policies preclude broadband competition by CLECs for small and medium sized business customers, the very segments that appear to be lacking competitive alternatives. Consequently, our analysis corroborates that open access policies can play a crucial role in advancing the evolution of our nation's broadband infrastructure.

Specifically, our analysis illustrates how the FCC's historical retreat from an open access broadband policy, via its forbearance orders and related decisions, has impeded the ability of CLECs to participate in broadband markets not just by limiting the availability of essential facilities but also raising their costs to prohibitive levels. In light of these findings, we conclude that the FCC should reexamine its "closed" broadband policies relative to the ILEC networks, and consider taking affirmative steps to reinvigorate competitive provision of broadband services by CLECs. Two of the most important steps would include: (1) guaranteeing continued competitive access to the ILECs' legacy copper networks and (2) expanding CLEC opportunities for access to include portions of the ILECs' emerging fiber-based broadband networks. Incorporating these actions into the National Broadband Plan could begin the process of reversing the nation's broadband performance trajectory and move forward towards the goal of bringing affordable, high-quality broadband services to all Americans.